HLTH-1: Forest Area and Conditions

Roger C. Conner and Andrew J. Hartsell

Southern Research Station, USDA Forest Service

What are the history, status, and projected future of southern forests?

1 Key Findings

- Area of timberland has increased by 5 million acres during the past 10 years. Since 1952 the area of hardwoods and oak-pine has increased while pine area has decreased.
- In 1952, natural pine stands occupied 72 million acres and planted pines covered 2 million acres, or 1 percent of the timberland area in 12 of the 13 Southern States. By 1999, planted pine stands occupied 48 percent of the area of pine in the region.
- Urbanization surpassed agriculture as the primary cause of loss of forest land in 1984. As of 1987, the South began gaining forest land faster than it was being lost. By 1990, annual gains in forest land amounted to 1.3 million acres, while diversions of forest land to other uses amounted to 841,000 acres.
- Timberland owned by forest industry declined for the first time between 1989 and 1999. Private corporate ownership rose from less than 16 million acres in 1982 to nearly 20 million acres in 1999, partly due to increased holdings by Timber Investment and Management Organizations (TIMOs). TIMOs controlled 4.2 million acres, or 2 percent of the South's timberland area in 1999 (TIMBR-2).
- Between 1953 and 1999, total growing-stock volume rose 72 percent, while average annual growth and mortality went up 60 percent and 130 percent, respectively. Average annual removals of growing-stock have risen 52 percent since 1982.
- As of 1999, nonindustrial private forest (NIPF) landowners controlled 71 percent of the timberland area; they have held at least 70 percent of the total growing-stock volume since 1953.
- Planted stands accounted for only 12 percent of the region's total growing-stock volume in 1999, but contributed 43 percent of the softwood net annual growth and 35 percent of annual softwood removals.
- Average annual removals of softwood growing stock exceeded average annual growth for the first time in 1999. However, softwood growth should rise once trees on 21 million acres of softwood saplings/seedlings stands reach growing-stock size and begin contributing to estimates of net annual growth.

2 Introduction

The South has 215 million forest acres, which represent 29 percent of the forest land in the United States. This estimate of forest land includes reserved areas, woodlands, and “commercial forest land,” which is now referred to as productive timberland.

The pine and hardwood stands of today differ markedly from those that were here 100 and 200 years ago, and the changes continue. The importance of forests and the changes that were occurring in them led Congress in 1928 to pass the McSweeney-McNary Act, creating Forest Survey Units in the USDA Forest Service and laying the foundation for a nationwide forest inventory system. Now called Forest Inventory and Analysis (FIA), Forest Survey in the South began in the bottomlands of the Mississippi Delta in 1932 (Frayer and Furnival 1998). By 1933, the initial inventories of the pine forests of south Georgia and north Florida were well underway (Knight 1972), and by 1940, the first forest inventories of Florida, Georgia, North and South Carolina, and Virginia were complete. Kentucky and Tennessee were the only Southern States where an inventory had yet to begin. Kentucky, first inventoried in 1949 as part of the Northeastern States survey, became the responsibility of the southern FIA in 1995. The initial inventory of Tennessee was completed in 1950.

After World War II, the second round of Southern State inventories began, and subsequent surveys in the South have followed at roughly 10-year intervals. Since the beginnings of Forest Survey, every State in the South (except Kentucky) has been inventoried at least six times. Today, 7th or 8th inventories are underway in 12 Southern States, and Kentucky is being inventoried for the fifth time.

Because timber supply was then the primary concern, the early Forest Survey efforts focused on determining the amount of wood volume available at the time. Through the years, inventory procedures have been revised many times as new sampling designs and methods were tested and adopted. The early line-plot method gave way to fixed-area samples, which were dropped in favor of variable-radius sampling in the late 1950's. The current forest inventory methodology is a mapped-plot design, used for the first time during the 1997 inventory of Georgia and for the 1999 survey of Tennessee. In addition to using a new sampling design, FIA in the South is currently changing from its traditional periodic inventories, to an annual forest inventory system.

As survey methods changed over the years, so did the scope of the inventories. The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 broadened the responsibilities of FIA to include all renewable resources on the Nation's forests and rangelands. In addition to the traditional timber-related data, this new "multiresource" inventory began collecting information on recreation, wildlife habitat, forested range, soil, and water (Van Hooser and others 1992).

This Chapter describes the changes and trends in southern forests over the past 50 to 100 years, primarily based on FIA statistics. Analyses focus on the amount and distribution of timberland area by stand age, forest type, stand size, and ownership, as well as on changes in volume, growth, mortality, and removals of timber.

3 Methods

Summaries of data published in the 2001 RPA report (Smith and others 2001) were used to examine the early history of land use and management of forest land in the South. The RPA estimates for the earliest years are taken from a variety of historical accounts, observations, and initial timber resource reports. More recent data are taken from summaries of statewide inventories conducted by FIA.

3.1 Pre-European settlement up to the 1930's

Historical descriptions of the extent and condition of southern forests present at this time come from anecdotal accounts and observations. This information covers the period from pre-European settlement up to the 1930's, the beginning of forest inventories in the South. Estimates of forest land area, volume, growth, removals, and mortality for the years 1630 and 1907 were taken from the 2001 RPA report (Smith and others 2001).

3.2 1930's-1970's: the early FIA inventories

Sources of initial inventory data, collected and summarized for each State by FIA between 1934 and 1950, are published statistical and analytical reports. However, subsequent changes in sampling design and methods, standards, and definitions make the FIA data from these initial inventories largely incompatible with results of later inventories. The results of the early inventories are limited to published estimates of forest land area, timber volume, and a few other variables. The 1938 resource estimates, taken from the 2001 RPA report, were used to represent the period between 1934 and 1950. Resource data for the 1950's to the 1970's also come from the 2001 RPA report, specifically for the years 1953 and 1963. RPA estimates for 1953 and 1963 are essentially summaries of past FIA statewide inventories, updated in some cases to a common year.

3.3 1970's to 1999

The bulk of the results and discussion of southern forests in this Chapter are based on analyses of FIA data collected since the 1970's. FIA data collected over the past 3 decades are compatible and consistent and allow for general comparisons and analyses of trends in forest area, volume, growth, mortality, and removals. Differences in sampling methods, and changes in design, standards, and definitions are noted. Definitions of FIA data variables are included in the report glossary. A general description of the sampling designs and methods used by FIA to conduct the past three statewide inventories is provided at the end of this Chapter.

Analyses were based on data for all 13 States aggregated into three "report" years--1982, 1989, 1999--using the past three surveys of each State:

	Report year		
State	1982	1989	1999
Alabama	1972	1982	1990
Arkansas	1978	1988	1995
Florida	1980	1987	1995
Georgia	1982	1989	1997
Kentucky	1975	1975	1988
Louisiana	1974	1984	1991
Mississippi	1977	1987	1994
North Carolina	1974	1984	1990
Oklahoma	1976	1986	1993
South Carolina	1978	1986	1993
Tennessee	1980	1989	1999
Texas	1975	1986	1992
Virginia	1977	1986	1992

The 1982 report year includes data for States inventoried between 1972 and 1982, including the 1975 survey of Kentucky. The 1989 report year, with the exception of Kentucky, includes State surveys conducted between 1982 and 1989. In order to include Kentucky and provide analyses for the entire South, data from the 1975 inventory were used to represent both the 1982 and 1989 report years. In a few cases where the 1975 FIA data for Kentucky were not available, estimates from the 2001 RPA report were used. The 1999 report year includes surveys

conducted between 1990 and 1999, again with the exception of Kentucky. The most recent inventory of Kentucky, completed in 1988, was used to represent the 1999 report year.

4 Data Sources

The FIA data discussed in this Chapter are from published reports, and from extensive databases residing at the Southern Research Station's FIA Work Units in Asheville, NC, and Starkville, MS. Additional data come from the 2001 RPA report (Smith and others 2001). Decadal RPA assessments, based on data collected by FIA units, have been published since the 1970's and provide trends and current status in key resource variables. Data from The South's Fourth Forest (USDA Forest Service 1988) report also were used to describe past use and management and track more recent trends in southern forest resources. Additional information was gathered from published literature that is cited appropriately.

5 Results and Discussion

5.1 Changes in forest land area in the South

Forest land, as defined by FIA, is at least 10-percent stocked by trees of any size, or formerly having had such tree cover, and is not currently developed for nonforest use. The minimum area considered for classification is 1 acre. Estimates of forest land include all reserved, woodland, and timberland acres in the 13 Southern States.

Although actual inventories of forest land in the United States did not begin until the 1930's, estimates of forest land for individual Southern States are available from RPA (Smith and others 2001) as far back as 1630 (Table 1). These early estimates are based on the current area of forest land and on accounts of land clearing and settlement by Native Americans and European settlers. This "original forest" area is presented only for comparison with what remains today.

The area of forest land in the South has changed dramatically since European settlement. It is estimated that there were 354 million acres of forest land in 1630 (Figure 1). Descriptions and anecdotal accounts of the appearance of the forests at that time reveal a landscape very different from that which we see today (History Background Paper). By 1907, the area of southern forests had declined by one-third to 236 million acres. Much of the decline was due to clearing for homes, crops, and pasture. The continued influx of people, the lack of a concerted effort to regenerate cleared forest land, and uncontrolled wildfires led to further declines over the next 3 decades, and by 1938 forests occupied 221 million acres.

The Civilian Conservation Corps and the Agricultural Conservation Program of the 1930's, and the Soil Bank Program of the 1950's helped return millions of cleared acres to forest (USDA Forest Service 1988). Between 1938 and 1963, area of forest land in the South rose by 7 million acres to 228 million. This gain was short-lived, however, and by 1982 forest area dropped to 218 million acres as 10 million acres of forest land were cleared for farming and development. The

loss of forest land continued over the next 7 years, and the total area declined to a low of 212 million acres. To help reverse this latest downward trend, the Conservation Reserve Program was established in 1985. It provided farmers with monetary incentives to plant trees on highly erodible cropland. These incentives and other efforts apparently had the intended affect. By 1999, southern forest area had increased by 3 million acres to 215 million acres. However, since 1907 the South has lost nearly 21 million acres, or 9 percent of its forest land.

5.1.1 Diversions of forest land to agriculture and urbanization

Since the 1930's, FIA has tracked the changes in the area of forest land by classifying current and previous land use at each sample location. Acres that were previously forested but are now cleared for agriculture or developed for some other nonforest use are called diversions. Diversions to agriculture or an urban land use account for the majority of the losses of forest land in the South. Average annual diversion of forest land to these nonforest land uses between 1968 and 1990 are shown in Figure 2. Data for Figure 2 were compiled from published FIA reports on file at the Southern Research Station, Asheville, North Carolina. Data for Kentucky were not available.

The area of cropland and pasture peaked in the 1920's and has been declining since (USDA Forest Service 1988). The reduced demand for agricultural land is reflected in the rate at which forest land was cleared for crops and related uses. In 1968, forest land was being converted to agriculture at the rate of 1.1 million acres per year (Figure 2). By 1990, the annual rate of conversion had declined to 308,000 acres.

In contrast, the rate of forest land lost to urbanization, until recently, has increased steadily, closely following the upward trend in the region's population (SOCIO-1). FIA estimates show that 377,000 acres of forest were lost to urban and other related land uses in 1968, and by 1978 the annual rate of loss had increased to 508,000 acres (Figure 2). By 1983 and 1984, urbanization was removing forest land from the South's timber base at an average rate of 540,000 acres per year, surpassing agriculture as the primary cause of loss of forest land. The rate of urbanization has declined in recent years, but in 1990 diversions of forest land to urban and related uses remained substantial, amounting to 406,00 acres. Cumulatively, forest land converted to agriculture or urban land uses during this 23-year period total 25 million acres. These figures likely include acres that have undergone more than one transition.

The fact that urbanization is apparently the primary reason for reductions in forest land holds important implications. Land clearing for crops and pasture is often transitory as economics, owner goals, and other factors dictate land use over time. For instance, timberland acres originally cleared for cotton over 50 years ago are once again supporting stands of hardwoods and pine. The same cannot be said for diversions of forest land to urban land uses, which are normally permanent.

5.1.2 Total change in forest land: additions and diversions

While losses to urbanization and agriculture were occurring, there were also concerted efforts throughout the South to regenerate nonforest land. Figure 3 shows the average annual change in total area of forest land in the South between 1970 and 1990. Total diversions include the acres of forest land converted to water, plus the diversions to agricultural or urban and other land uses already discussed. The primary source of additions to forest land is idle cropland or pasture, which regenerated naturally or was planted or seeded.

Average annual diversions to nonforest decreased steadily between 1970 and 1990, but they consistently outpaced the rate of additions (Figure 3). In 1970, total diversions removed 1.8 million acres from the timber base. Additions amounted to 787,000 acres, and the South experienced an average net loss of over 1 million acres of forest in that year. The rate at which nonforest was being regenerated reached a peak in 1972 at 829,000 acres. The annual rate of additions declined over the next 6 years, and the 1972 level was not surpassed until 1979 and 1980, when 839,000 acres were reforested annually. Cumulatively, 9 million acres of forest land were added between 1970 and 1980. The annual rate of diversions continued to slow, but still exceeded additions. By 1980, a total of 15 million acres of forest land had been diverted to a nonforest classification, resulting in a net loss of 6 million acres region-wide over the 10-year period. The gap between the rates of diversion and additions was closing, however. Evidence suggests that Federal Government initiatives such as the Forestry Incentives Program of the 1970's, were helping to slow the rate of deforestation and increase the rate of planting and reseeding on cleared and other nonforest land.

From 1980 to 1986, average annual rate of diversions remained fairly stable at around 1 million acres. Annual additions to forest land rose from 839,000 acres in 1980, to 972,000 acres by 1986. Cumulative losses of forest since 1980 amounted to 6.6 million acres, but additions totaled 5.5 million acres, for a net loss of 1.1 million acres over the period. There also is evidence that the more recent Federal incentives, such as the Conservation Reserve Program established in 1985, have helped slow the rate of diversion. A milestone was reached in 1987 when the South gained more forest land than it lost. That year, 1 million acres were added to the timber base, while 953,000 acres were diverted to other uses. By 1990, nonforest land was being converted to forest at a rate of 1.3 million acres, and diversions out of the timber base declined to 841,000 acres annually. Cumulative additions over the last 4 years of the period amount to 4.9 million acres, and diversions totaled 3.5 million acres.

The most recent year in which the additions/diversions data collected by FIA are available for each State is 1990. Current and future inventories will provide additional data to track the changes and trends in the South's forest land area in all 13 States. However, the increase of 3 million acres of forest between 1989 and 1999 shown in Figure 1 suggests that the general trend in additions and diversions witnessed between 1987 and 1990 has continued over the past decade.

5.2 Changes and trends in timberland area

Timberland, formerly called commercial forest land, is the primary component of forest land and is defined by FIA as forested acres capable of producing at least 20 cubic feet of industrial wood per year, and not withdrawn from timber utilization. Figure 4 shows trends in total timberland area since 1953, along with estimates for reserved and other forest land. “Other forest land” is forested land that does not meet the minimum standard of productivity to be classified as timberland, and land primarily stocked with tree species that are typically of poor form and quality. Examples of other forest land are the slow-growing "hatrack" cypress stands, the mangrove thickets in south Florida, and "scrub oak" and hickory on marginal sites in Oklahoma, Texas and other Southern States. Reserved forest land includes State and National Parks, Monuments, Wilderness Areas, and other forested areas set aside by law or administrative designation. The reserved area estimates were taken from the 2001 RPA report (Smith and others 2001). These estimates include acres previously classified as unproductive reserved, and include the western portions of Oklahoma and Texas, areas that traditionally were not inventoried by FIA. Therefore, the reserved and other forest land estimates in Figure 4 will be higher than those reported by FIA.

The area of timberland reported in 1953 amounted to 205 million acres. Timberland area peaked a decade later at 209 million acres. Some of this increase was due to a reclassification of other forest land to timberland. By 1989, timberland had declined to 196 million acres--a 4-percent drop since 1953 and a 6-percent decline from 1963. This was the low point in area of timberland; over the past 10 years timberland has increased to 201 million acres. The area of reserved and other forest land has decreased steadily, from 22 million acres in 1953 to less than 13 million acres in 1989 and 1999. Again, the reclassification of other forest land to timberland accounted for most of the decline

5.2.1 Changes and trends in timberland area by State

Changes in area of timberland between 1953 and 1999 for individual States are shown in Figure 5. Nearly all Southern States experienced both gains and losses of timberland during this period. The few exceptions are Florida and Louisiana, which have consistently lost timberland, and Kentucky, which is the only State to register gains in timberland area in successive inventories since 1953.

Florida has lost the most timberland, primarily due to urbanization. Since 1953, timberland area in the State has declined 19 percent to less than 15 million acres in 1999. Louisiana has lost more than 2 million acres of timberland over the past 46 years, but area has remained fairly stable during the past decade at about 14 million acres. Louisiana's timberland acres lost to agriculture, particularly in the Mississippi Delta, have stabilized. However, since the mid-1970’s annual losses to urbanization have been on the rise.

Kentucky gained 412,000 acres of timberland between 1953 and 1989. The State's timberland area increased by another 438,000 acres to over 12 million acres by 1999. In all, only 5 States have more timberland area today than was estimated in 1953. However, all States, except

Florida and Louisiana, have shown an increase in timberland over the past decade. Largest gains in area occurred in Mississippi, with the addition of nearly 2 million acres to its timber base since 1989, and Arkansas, where an additional 1 million acres are now forest land.

5.3 Trends in ownership

Ownership is at the center of many current issues surrounding the South's forest land. FIA identifies and tracks ownership of every forested sample location by accessing county records. Changes in the patterns of land ownership, the number and types of southern landowners, and their many and varied reasons for owning forest land are important factors affecting the past, present, and future condition of the region's forest resources.

The South's timberland is held by two broad owner groups: public or private. Public ownership has accounted for between 9 and 11 percent of the timberland acres in the 13 Southern States over the past 46 years. In 1999, 21 million acres--11 percent--were publicly owned (Figure 6 and Table 2). Public land includes national forests, and other public timberland administered by State, county and municipal agencies, miscellaneous Federal agencies, and Native Americans. Timberland in the "other public" category totaled 7 million acres in 1953, and 10 million acres in 1999.

The USDA Forest Service managed 12 million acres of southern timberland in 1999. This figure has changed little in the last 40 years. Much of the area that is now national forest was once cutover timberland and highly eroded cropland (Shands and Healy 1977). Legislative efforts to reclaim these areas began in 1907 with the establishment of the South's first national forest: the Ouachita National Forest in Arkansas and Oklahoma (USDA Forest Service 2000). The reclamation efforts continued through the late 1930's with the purchase of national forest land in every Southern State. The last national forest created in the South was the Uwharrie established in North Carolina in 1961 (Table 3). The National Forest System acreages reported in Table 3 include nonforest land and are, therefore, higher than FIA estimates of national forest timberland.

Private landowners historically have held the lion's share of the South's timberland area. Private owners controlled 91 percent in 1953, and 89 percent remained in their hands in 1999. The two major groups of private owners are forest industry and nonindustrial private forest (NIPF) landowners.

Until recently forest industry acreage continually increased, from 32 million acres in 1953 to a peak of 38 million acres in 1989 (Figure 6). Industry ownership southwide declined for the first time between 1989 and 1999, falling to 37 million acres. Florida and Georgia combined showed a decline of more than 1 million acres of industry timberland since 1989, and both South Carolina and Virginia registered substantial losses (Table 2). Industry timberland is typically the most intensively managed and the most readily available source of raw material for the South's timber products industries. Therefore, even small declines in industrial ownership can have major impacts. However, much of what was previously forest industry timberland is now in the

hands of private corporations. Many believe these corporate timberland acres will continue to be managed for wood products.

NIPF timberland owners hold more acres than any other owner group, public or private. This remains true even though their holdings declined between 1963 and 1989, reflecting the decline in total timberland area throughout the South. NIPF timberland, which amounted to as much as 157 million acres in 1963, declined to 137 million acres by 1989. In 1999, NIPF timberland was up to 142 million acres, an increase of 4 percent over the past decade.

5.3.1 Trends in nonindustrial private timberland

Private landowners often buy or sell timberland. Shifts in acres of timberland among nonindustrial private forest landowners can have immediate affects on the extent, management, condition, and availability of southern forest resources.

Historically, the NIPF owner group included three ownership classes: farmers, corporations that do not manufacture forest products, and private individuals. However, beginning with the 1999 inventory of Tennessee, the farmer category was dropped and these acres were included in the private individual owner class. To show general trends, the estimate of timberland owned by farmers from the previous survey of Tennessee was used to represent the recent inventory.

Timberland under NIPF ownership in Kentucky amounted to 11 million acres in 1999 (Table 2), but the distribution of this area among farmer, corporate, and individual ownerships was unavailable. Therefore, the trends shown in Figure 7 do not include Kentucky.

Trends in nonindustrial private timberland since 1982 revealed increases in both corporate and individual ownership, accompanied by declines in timberland owned by farmers. The decline in farmer-owned timberland is a long-standing trend. In 1952, it is estimated that farmers held as much as 88 million acres, or two-thirds of the area of southern timberland (Healy 1985). Farmer-owned timberland declined over the next 30 years to about 51 million acres in 1982 (Figure 7). Recent estimates place farm ownership at just 35 million acres in 12 Southern States. Only Arkansas experienced a recent increase in farmer-owned timberland--,a rise of 7 percent to 3 million acres between 1989 and 1999.

Corporate ownership rose from 16 million acres in 1982 to about 20 million acres in 1999. Recent additions to the corporate owner class are the timber investment and management organizations (TIMO's). Timber investment groups include banks, insurance companies, agribusiness, realty investment and development firms, and utility companies. Some 4 million acres of timberland in the South were in the hands of TIMO's in 1999 (TIMBR-2). The outlook is for increased corporate investment in the South's timberland by these and similar companies. The rise in corporate timberland, and the decline in timberland owned by forest industry is a recent trend seen in several Southern States (Table 2). If this trend continues, corporate timberland will eventually play a larger role in the South’s timber industry, perhaps offsetting the loss of acres owned by forest industry.

The final component of the NIPF owner class is private individuals. Individuals typically have owned the largest share of southern timberland and held 76 million acres in 1999. The 1999 estimate represents a 9-percent increase in timberland area held by private individuals since 1989, and an 18-percent increase since 1982.

5.3.2 Ownership, tract size, and the potential for forest fragmentation

One potential effect of an increase in the area of timberland owned by individuals is forest fragmentation--the breaking up of contiguous forest stands into smaller pieces due to clearing for agriculture and urban development (TERRA-1). In 1990, FIA began collecting tract-size information for all nonindustrial private ownerships throughout the South. This information will provide a baseline for measuring future trends. Changes in average tract size, and estimates of the number of private forest landowners and parcels owned, as discussed by Wicker (SOCIO-4), can provide additional indicators of the potential for forest fragmentation.

To date, tract-size data have been collected in five States--Florida, Georgia, South Carolina, Tennessee, and Virginia--containing 56 million acres of NIPF land (Thompson and Johnson 1996, Thompson 1997, Thompson 1999). Estimates from recent inventories show 27 million acres in these States were forested tracts of 100 acres or less, including 17 million acres with a tract size of 50 acres or less (Figure 8). Less than 9 million acres of private timberland were in tracts greater than 500 acres.

Among forest management types, pine plantations tend to be in larger tracts. One-half of the 7 million acres of pine plantation on private timberland were in tracts greater than 200 acres, and another 21 percent were tracts of 101 to 200 acres (Table 4). Only 15 percent of planted pine stands were in tracts of 50 acres or less. In contrast, roughly half of the timberland acres in all other management types were in tracts of 100 acres or less.

Additional State surveys will tell if the tract-size distribution of NIPF land in these five States is representative of the entire South. If so, then nearly half of the South's nonindustrial private timberland is composed of stands of less than 100 acres, and less than one-fifth is in contiguous tracts greater than 500 acres. Smaller tract sizes hold implications for wildlife habitat, and affect resource management decisions (TERRA-1). Studies have shown that the practicality of timber management declines as tract size decreases (Thompson and Johnson 1996, Thompson 1997, Thompson 1999, Birch and others 1982, Birch 1997), and that landowners with the fewest acres have the fewest management options (TIMBR-3).

5.4 Timberland distribution, composition and stand structure

The South's physiography largely determines the distribution and composition of its forests. In general, hardwoods are dominant in the Mountains and much of the Piedmont Plateau, and softwoods predominate in the Southern Coastal Plains. The composition and structure of southern timberlands can be described by the distribution of forest types, stand size and age, and stand origin. Forest types are based on the tree species forming a plurality of live-tree

stocking. Stand size is based on the diameter distribution of all live trees in a stand, while stand age represents the age of the dominant and codominant trees in the stand. Stand origin identifies a stand as having been established through natural regeneration, or through planting or seeding by humans.

5.4.1 Distribution of timberland area by forest type

Changes over the past 50 years have altered the extent and distribution of hardwood and softwood forest types throughout the South. Overall, area in hardwoods and oak-pine has been increasing and the area in softwoods has been decreasing. In 1953, upland and lowland hardwood forest types combined accounted for 46 percent of the region's timberland, or 94 million acres (Figure 9 and Table 5). In 1999, hardwood forest types combined accounted for 52 percent of the South's 201 million acres of timberland. Oak-pine stands occupied 12 percent of the area in 1953, and 15 percent in 1999. Softwood forest types--principally longleaf-slash pine and loblolly-shortleaf pine--occupied 39 percent of the South's timberland area in 1953, but have accounted for less than one-third since 1982.

Most notable among the trends in softwood forest types is the continued decline in the area of longleaf-slash pine types. Longleaf pine is estimated at one time to have occupied 60 million acres in the Coastal Plain and Piedmont areas of the Atlantic Coast States (McWilliams and others 1997). By 1953, the combined area of longleaf-slash pine forest types had declined to 27 million acres. In 1999, area of longleaf-slash pine had been reduced to 13 million acres. Two-thirds of the acres of longleaf-slash pine remaining in 1999 were in Florida and Georgia (Table 6).

Loblolly-shortleaf pine forests have accounted for about one-fourth of the South's timberland area since 1953 (Figure 9), despite a steady decline in actual acreage; from 52 million acres to a low of 46 million acres in 1989 (Table 5). The area of loblolly-shortleaf increased to 50 million acres by 1999, and still accounted for one quarter of the South's timberland area.

The white-red-jack pine forest-type group occupied 688,000 acres in 1999. This national standard type-group is somewhat of a misnomer in the South. While white pine is a component of red and jack pine forest types in more northerly climes, in the South this forest-type group is composed almost entirely of white pine forest types.

Upland hardwoods--oak-hickory and maple-beech-birch forest types--accounted for 37 percent of the timberland area in 1999. The area of oak-hickory increased steadily between 1953 and 1999, from 55 million acres to 74 million acres (Table 5). Oak-hickory timberland increased in 9 of the 13 Southern States since 1982, including the addition of 2 million acres in Alabama (Table 6). Maple-beech-birch forest types increased from 750,000 acres to 1 million acres between 1953 and 1999.

Lowland hardwoods, which in the past have accounted for as much as 19 percent of southern timberlands, occupied 15 percent of the area of timberland in 1999. Acres of oak-gum-cypress

and elm-ash-cottonwood, which comprise the lowland hardwood group, declined from 39 million acres to 31 million acres over the past 46 years.

5.4.2 Distribution of timberland by stand size

- The FIA classification of timberland acres by stand size gives an indication of the predominant size of the trees present. Each stand-size class--sawtimber, poletimber, and sapling-seedling--is defined by a specific range of diameters and by the trees comprising a plurality of live-tree stocking:

- *Sawtimber stands*. Stands at least 16.7 percent stocked with live trees, with half or more of total stocking in sawtimber and poletimber trees, and with sawtimber stocking at least equal to poletimber stocking. Sawtimber trees are softwood species at least 9.0 inches in diameter at breast height (d.b.h.), and hardwood species at least 11.0 inches d.b.h.

- *Poletimber stands*. Stands at least 16.7 percent stocked with live trees, of which half or more of total stocking is in poletimber and sawtimber trees, and with poletimber stocking exceeding that of sawtimber. Poletimber trees are live trees of any species at least 5.0 inches d.b.h., but smaller than sawtimber.

- *Sapling-seedling stands*. Stands at least 16.7 percent stocked with live trees of which more than half of total stocking is saplings and seedlings. Saplings are live trees 1.0 to 5.0 inches d.b.h., and seedlings are trees less than 1.0-inch d.b.h.

Timberland acres with less than 16.7 percent stocking are classed as nonstocked.

The distribution of timberland by stand size has changed considerably since 1953 (Figure 10). Acres of sawtimber and sapling-seedling stands have increased, while acres of poletimber stands and nonstocked acres decreased. Poletimber stands dominated in 1953, accounting for 41 percent of the acres of timberland (Smith and others 2001). Less than one-third of the stands were sawtimber, roughly one-fifth were classified as sapling-seedling stands, and 8 percent were nonstocked. A decade later, sawtimber and poletimber stands each occupied 35 percent of the South's timberland area. In 1963, stands with a plurality of stocking in saplings and seedlings accounted for nearly one-fourth of the area. These general trends continued, and by 1999 45 percent of the timberland area was in sawtimber stands; one quarter was in poletimber stands; 29 percent was in sapling and seedling stands. Only 1 percent was nonstocked in 1999.

The trends in stand size differ for hardwoods and softwoods (Table 7). Since 1982, the upward trend in the total area of sawtimber has been driven by increases in hardwood sawtimber. Hardwood sawtimber rose 17 percent to 65 million acres in 1999. Every State in the South, except South Carolina and Texas, had more hardwood sawtimber stands in 1999 than in 1982. Part of the reason for the increase is basic economics. Hardwood species are generally less desirable for timber products until they reach sawtimber size, and many hardwood stands are in remote mountainous areas, which are more difficult to log (TMBR-1). As a result, more trees are left to grow into the larger diameter classes.

The area of softwood sawtimber has declined 8 percent since 1982. Florida, Georgia, Mississippi, and Texas have lost softwood sawtimber in successive inventories, and Alabama, Louisiana, and South Carolina have fewer acres in this class now than in 1982. The remaining five States have slightly more acres of sawtimber than a decade ago. The decline in sawtimber--softwood and hardwood--in South Carolina between 1989 and 1999 was due at least in part to damage from Hurricane Hugo in 1989.

5.5 Trends in stand origin: planted pines and natural stands

Timberland acres originate from natural regeneration, or from planting or seeding by humans. Most hardwood stands have originated from natural reversion of nonforest land, or from natural regeneration after harvests of pine and hardwood sites. A large portion of the area of pine and oak-pine stands in 1999, however, originated by planting on nonforest acres, or artificially regenerated after a final harvest. Pine plantations, all but unheard of 50 years ago, are now nearly as common as natural pine and oak-pine stands throughout much of the South's Piedmont and Coastal Plain regions (Figure 11). In fact, recent FIA inventories showed that planted pine area exceeded natural pine in a few Southern States (Table 8).

This increase in the area of planted pine and the impact--perceived or real--that this trend has had on current southern forests, is arguably the most controversial issue in the South today. One means of tracking the shifts in natural and planted stands is to display the changes in timberland area by forest management types. FIA forest management types are classifications of timberland based on forest types and stand origin:

- *Pine plantation*. Stands that have been artificially regenerated by planting or direct-seeding are classed as a pine or other softwood forest type, and have at least 10 percent stocking.

- N*atural pine*. Stands that have not been artificially regenerated, are classed as a pine or other softwood forest type, and have at least 10 percent stocking.

- *Oak-pine*. Stands that have at least 10 percent stocking and are classed as a forest type of oak-pine. Hardwoods (usually upland oaks) constitute a plurality of the stand stocking, and pines account for 25 to 50 percent of stand stocking.

- *Upland hardwood*. Stands that have at least 10 percent stocking and are classed as an oak-hickory or maple-beech-birch forest type.

- *Lowland hardwood*. Stands that have at least 10 percent stocking and are classed as an oak-gum-cypress, elm-ash-cottonwood, palm, or other tropical forest type.

Regional trends in the distribution of timberland area by forest management type for all 13 Southern States are illustrated in Figure 12. The data for years 1952, 1962, and 1970 are from the South's Fourth Forest (USDA Forest Service 1988) report. The 1982, 1989, and 1999 report years are based on FIA inventory data.

In 1952, the area of planted pine was less than 2 million acres, or 1 percent of the timberland area in the South (Figure 12). Natural pine stands, which stretched from coastal Virginia south to Louisiana, covered 72 million acres in 1952, and natural oak-pine stands occupied another 28 million acres. These natural pine and natural oak-pine stands created a mosaic of longleaf pine, shortleaf pine, slash pine, loblolly pine, Virginia pine, and other pine species in pure stands, or mixed with oak, gum, and other hardwoods. Over the next decade, planted pine acreage reached 8 million acres as natural stands were harvested and regenerated, and as pine species were planted on idle cropland and other nonforest acres.

The Soil Bank Program of the late 1950's essentially marked the beginning of extensive pine plantations in the South (Frederick and Sedjo 1991). This Federal program provided incentives to landowners to "withdraw land from agriculture and put it into uses such as forestry." By 1962, planted pine stands accounted for 4 percent of the total timberland area, and 11 percent of the area of pine. Natural pine area declined to 65 million acres by 1962, and oak-pine increased to 29 million acres. This pattern of increasing area of planted pine and decreasing area of natural pine stands has continued over the past few decades. The rate of pine planting accelerated after the mid-1980's, helped along by Federal efforts such as the Conservation Reserve Program, which offered incentives to NIPF landowners to "convert highly erodible agriculture lands into forest" (Frederick and Sedjo 1991). In 1999, planted pine stands occupied 30 million acres, or 15 percent of the South's timberland area, and 47 percent of the area of pine in the region. Natural pine stands occupied 34 million acres in 1999.

Figure 13 and Table 8 show the trends since 1952 in area of timberland by forest management type and State. The figure and table include all forest management types, but, the primary focus of this discussion is on the changes in the area of natural and planted pine.

Florida and Georgia are typical examples of how the pine resource has changed throughout much of the South. In 1952, natural pine stands occupied 13 million acres in Georgia and planted pine stands totaled 357,000 acres. Florida's 10 million acres of natural pine was 57 percent of its timber base in 1952. The area of planted pine in Florida was just 291,000 acres that year. Together, these two States accounted for 24 million acres, or one-third of the natural pine resource in 12 Southern States in 1952. In 1999, the combined acreage of natural pine in both States amounted to 7 million acres. Acres of planted pine outnumbered those of natural pine in both States, and in Mississippi, as well. Natural and planted pine acreages were nearly equal in Alabama, Louisiana, South Carolina, and Virginia in 1999. Planted pine may surpass natural pine in these States in the near future.

The perception that planted pine is replacing natural pine and other forest types is not entirely correct. Some hardwood and natural pine stands, indeed, have been harvested and planted or seeded with pine. However, as previously discussed, much of the decline in natural pine and hardwood stands was due to diversions to agriculture and urban land uses. In addition, changes in the distribution of timberland area result from shifts of acres among forest management types.

5.5.1 Shifts in acreage of planted and natural stands: reclassifying forest

management types

Natural succession and disturbance, artificial regeneration, and timber harvesting alter species distributions and stocking levels. A change in forest management type often results. For example, when oak or other hardwoods become established in a natural pine stand, the management type classifications can change from natural pine, to oak-pine, and eventually to upland hardwoods. Or a planted pine stand, after a final harvest or following some intermediate treatment, can become stocked with enough hardwood stems to change its management type to planted oak-pine. Moreover, even if no harvesting or management activity occurs, a planted stand may, through natural succession, become indistinguishable from a natural stand and would be classified as natural pine, oak-pine, or hardwood.

Table 9 displays the changes in forest management types that occurred between 1989 and 1999. The columns of the table give the most recent (1999) estimate of acres in each management type. The extreme left column lists the previous management type, which identifies how these acres were classified in the previous (1989) inventory. Data for Kentucky were not available.

Using the management type totals for 12 of the region's 13 States, planted pine and planted oak-pine combined totaled 34 million acres in 1999. Most of that acreage--about 22 million acres--was classified as planted pine/oak-pine in the previous survey. Planted pine/oak-pine acreage increased 12 million acres between surveys. What was the source for the increase in acres of planted stands? More than 3 million of the additional acres classified as planted pine/oak-pine in 1999 were natural pine stands in 1989. Another 1 million acres of natural oak-pine were reclassified as planted stands, as were nearly 5 million acres of upland and lowland hardwoods combined. The change in management type classification for these acres likely occurred as the result of harvesting followed by artificial regeneration.

Acres previously classified as nonforest were sources for "new" planted stands. Between 1989 and 1999, over 3 million acres of nonforest land were regenerated and reclassified as planted pine/oak-pine stands. The greatest loss of timberland to nonforest occurred in upland hardwood forest types, which lost over 2 million acres since 1989.

Many timberland acres with a planted forest management type also were reclassified. In all, about 3 million acres identified as planted pine/oak-pine in 1989 were reclassified as natural stands by 1999. This change in type included 1 million acres reclassified as upland hardwoods, 970,000 acres reclassified as natural pine, and 408,000 acres reclassified as natural oak-pine.

5.5.2 Stand age structure: young pine plantations and older natural stands

The importance of stand age has increased as planted stands have accounted for an increasing percentage of the South's timberland area. Part of the argument against pine plantations is that the intensively managed, comparatively young planted pine stands lack the biological diversity of natural stands. This shortcoming makes plantations less desirable for wildlife habitat, recreation, and other forest-derived amenities.

As a general rule, management of pine plantations dictates that few stands ever reach 50 years old. Of the 34 million acres of planted pine/oak-pine stands in 1999, over half were less than 13 years old, and 81 percent were less than 23 years old (Figure 14 and Table 10). Planted stands reaching 50 years or older are often being managed for sawtimber, or are possibly no longer being managed at all, and were left to return to a natural condition.

Natural stands tend to encompass a wider range of stand ages, but few 100 year-old natural stands still exist in the South. In 1999, only 3 million acres of southern timberland supported stands older than 93 years, and 88 percent of those stands were hardwoods (Table 10).

The age distribution for hardwoods showed that most stands were between 33 and 62 years old (Figure 14). Thirty-four percent of hardwood stands were younger than 33 years, and less than one-quarter were older than 62 years. Natural pine/oak-pine acres were skewed toward comparatively young age classes--53 percent of the stands were less than 33 years old.

5.6 Trends in growing-stock volume

Historically, FIA has reported tree volumes based on the growing-stock classification. The definition of growing stock is a live tree of a commercial species that possesses, or has the potential to produce a 12-foot sawlog. The log(s) must meet dimension and merchantability standards and have at least one-half of the gross board-foot volume in sound wood. This definition was modified in 1988. The new definition states that trees should have one-third of the gross board-foot volume in sound wood. Except for this and a few other changes, the definition of growing-stock has remained constant and provides a steady benchmark to investigate trends in tree volume. The FIA data used in this report do not include volumes of trees less than 5.0 inches d.b.h. All volume data are derived from the 2001 RPA report and include the State of Kentucky, except any analysis performed using forest type. Volume by forest type was investigated using FIA data that excluded Kentucky so that the impacts of pine plantations could be reported.

Volume has increased between survey periods for both hardwood and softwood growing stock. This increase has been fairly steady, except for a slight leveling off after 1982. Between 1953 and 1999, total volume increased from 148,470 million cubic feet (MCF) to 256,361 MCF (Table 11). The volume of softwood growing stock increased from 60,462 MCF to 104,846 MCF (Table 12), and hardwood volume increased from 88,008 to 151,515 MCF (Figure 15, Table 13). The majority of this change took place between 1953 and 1982. This period accounted for 69 percent of the total increase in growing-stock volume, 92 percent of the increase in softwood volume, and 54 percent of the increase in hardwood volume.

State and Federal reforestation programs stimulated the increase in volume after World War II. Volume increases in the late 1960's to mid 1970's are a direct result of the maturing of trees planted by these reforestation projects. Data from the South's Fourth Forest (1988) indicate a huge increase in the number of acres reforested in the mid 1950's to early 60's, with a peak of 1.7 million acres in 1959. The increase in growing stock in Table 11, Table 12 and Table 13 is a direct result of this reforestation effort.

5.6.1 Changes in volume by diameter class

Changes in total growing-stock volume by 2-inch diameter class are displayed in Figure 16. Note that the second to last diameter class encompasses all trees 21.0 to 28.9 inches d.b.h. This broad class explains the large bump at the end of each year's curve. The increase in volume from 1953 to 1982 was particularly high for trees less than 14.0 inches d.b.h. This situation is attributable to the fact that trees are not included in estimates of growing-stock volume until they reach 5.0 inches d.b.h. At that time, their volume is added to the inventory and is called "ingrowth." Since 1982, the volume in the 9.0- to 10.9-inch diameter class has never varied by more than 3 percent (Table 14**).** The volume of growing-stock trees for diameter classes greater than 10.9 inches has increased steadily in successive survey periods.

For softwood growing stock, volume in all years peaks in the 9.0- to 10.9-inch diameter class (Figure 17). This peak was greatest in 1989, as recent surveys show a slight decrease in volume for this tree size. All years have increases in volume for each diameter class greater that 13.0 inches d.b.h. (Table 15). For hardwood growing-stock, volume peaks in the 10-inch diameter class (Figure 18, Table 16). The general shape of the hardwood distribution curve is more rounded, with very large volumes in the 9.0- to 10.9-, 11.0- to 12.9- and 13.0- to 14.9-inch diameter classes. Conversely, softwood growing-stock volume is concentrated in the smaller diameter classes.

5.6.2 Volume of growing-stock by ownership

Because NIPF landowners hold the lion's share of the South's timberland, it follows that the majority of the volume occurs on their land (Figure 19**).** NIPF landowners have always accounted for 69 to 72 percent of the total growing-stock volume in the South (Table 17). The growing-stock volume for all ownerships has increased in each survey period. The increases in growing stock volume brought about by the reforestation efforts of the 1930's, 1950's and early 1960's are clearly seen in Figure 19, particularly for NIPF land.

In 1953, NIPF landowners controlled 71 percent of the growing- stock volume. Since then, the proportion controlled by NIPF owners has declined due to major increases for other types of owners. Growing-stock volume on forest industry land increased 47 percent from 1953 to 1999. The volume on national forests increased 109 percent, and that on other public land increased 237 percent.

5.6.3 Volume trends by forest type

The area of hardwood and mixed pine-hardwood stands has increased over the last 50 years, while the area of pine has declined. These changes in area caused changes in volume distributions by forest type (Figure 20). The volume in mixed pine-hardwood stands increased almost 10 percent between 1989 and 1999, while the volume in all hardwood stands increased 12 percent (Table 18). The majority of the hardwood volume is in the oak-hickory forest type, which

comprised around one-third of all growing-stock volume, and approximately 60 percent of all hardwood volume in both years.

Southern pine growing-stock volumes increased only slightly between 1989 and 1999, from 77,756 MCF to 78,800 MCF. The area of southern pine timberland increased 3 percent during this period. Comparing natural southern pine stands to planted stands produces some interesting results. Natural longleaf-slash pine and natural loblolly-shortleaf pine are two of the three forest types that lost volume in the 1990's. Elm-ash-cottonwood forest types also lost volume. Planted southern pine stands increased in volume by 66 percent from 1989 to 1999. These increases can be attributed to the Conservation Reserve Program. In 1989, pine plantations held 6 percent of the South's total growing-stock volume. By 1999, plantations accounted for 10 percent of the total growing stock volume.

5.7 Trends in growing-stock growth

The effects of reforestation and the resulting volume increases had a dramatic effect on growing-stock growth. As growing-stock volume increased during the first three survey periods after World War II, so did the average annual growth of growing stock (Figure 21). From 1953 to 1982, total growing-stock growth increased from 6,683 MCF per year to 11,323 million cubic feet per year (MCF/yr). During this period, softwood growing-stock growth increased by 74 percent, while that of hardwoods increased 65 percent (Table 19). After 1982, growth of both softwoods and hardwoods decreased slightly. From 1982 to 1999, average annual growth of softwoods declined 7 percent and hardwood growth decreased 4 percent. These data indicate that average annual growth of growing stock peaked in the 1970's, and has since leveled off. After a decline in 1982, the subsequent survey showed a slight increase,7 percent, in average annual growth. This increase corresponds to the time when gains in forest land in the South began to outpace losses (Section 6.1.2). Changes in timberland area often lead to changes in growing-stock growth. Therefore, this increase in area produced an increase in average annual growth of growingstock.

It is important to realize that while the rate of growth has slowed since the mid-1970's, growth is still occurring. In 1999, southern forests produced 10,712 MCF of wood per year.

Dividing average annual growth by growing-stock volume creates a ratio that reveals the relationship between growth and standing volume. Historically, average annual softwood growth represented between 5.25 and 6.25 percent of the total softwood growing-stock volume (Figure 22). Hardwood growth rates fluctuated between 3.5 and 4.1 percent. The dip in average annual growth that occurred due to changes in timberland during the 1970's is clearly visible in the figure.

5.7.1 Growth trends by ownership

Because NIPF landowners control the majority of the timberland, growth on NIPF land mimics the trend of all landowners (Figure 23**)**. Average annual growth of growing stock is the average increase in volume of growing-stock trees. It includes any volume from new trees or

timberlands. Average annual growth of growing stock on NIPF land was 4,586 MCF/yr in 1953 and increased to 7,962 MCF/yr by 1982 (Table 20). The growth rate dropped to 6,851 MCF/yr in 1989 before reaching the latest level of 7,201 MCF/yr.

Growth rates on forest industry land and national forests differ from the NIPF trend, and from as each other. Growth on national forests rose from 432 MCF/yr in 1953 to a peak of 667 MCF/yr in 1982. However, by 1999, the average annual growth on national forests was back to 498 MCF/yr. Conversely, growing stock growth on forest industry land reached its highest point 2,574 MCF/yr in 1999.

The reason for the differing patterns of growth rates lies in the motives and management practices of the two different ownerships. Forest industry tries to maximize profit and therefore the volume cut in its operations. This approach leads to management practices that focus on smaller, younger trees that grow more vigorously. Thus, forest industries growth rates benefited in the 1950's, 1960's and 1970's from early reforestation efforts, and during the 1980's and 1990's from its focus on smaller, faster-growing trees.

National forests are not managed to maximize timber production; they are managed to meet the needs of a diverse group of users. Many national forest management plans require long rotations. As these stands age, growth rates in them decline. Nevertheless, these stands produce fiber and wood products along with the other benefits for society.

Growth rates on other public timberland reached all-time highs in 1999. In fact, with the exception of the 1989 estimate, the average annual growth of growing stock for this land has increased steadily. A large part of the reason for this increased growth is land acquisition. From 1953 to 1999, 3.3 million acres of public land were acquired (Table 2).

5.7.2 Average annual growth by forest type

Annual growth of growing stock in various forest types has always been of keen interest. The average annual growth on growing stock in loblolly pine plantations more than doubled between 1989 and 1999 (Figure 24 **and** Table 21), going from 821 MCF/yr to 1,863 MCF/yr. Meanwhile, the growth of natural pine stands dropped from 2,703 MCF/yr to 2,316 MCF/yr. In 1999, planted stands accounted for 10 percent of the South's total growing-stock volume, but produced 23 percent of the average annual growth of growing stock.

Total growing-stock growth for the 12 Southern States rose from 9,381 MCF/yr to 10,478 MCF/yr. Forest types other than planted pine that gained growth were oak-pine with a 10-percent increase, oak-hickory with a 9-percent gain, and oak-gum-cypress with a 4.5 percent gain. The elm-ash-cottonwood, maple-beech-birch, and natural pine forest types all experienced decreases in average annual growth.

5.8 Status and history of growing-stock removals

Average annual removals of growing stock are defined as the average annual sound-wood volume of growing-stock trees removed from the inventory by harvesting, cultural operations (such as timber-stand improvement), land clearing, or changes in land use during the period between surveys. The latest RPA report has average annual removals data for three successive surveys of all 13 Southern States.

The RPA data indicate that removals of both softwoods and hardwoods have increased with each survey period (Figure 25), and softwoods consistently have been removed in greater amounts than hardwoods. In all periods, softwoods have comprised at least 64 percent of total growing-stock removals (Table 22). From 1982 to 1999, the average annual removals of softwood growing stock increased 46 percent, while hardwood removals rose 65.3 percent. Total growing-stock removals increased 52.4 percent.

The ratio of average annual removals to total growing-stock volume for hardwoods and softwoods reveals the same pattern (Figure 26). However, with each subsequent survey a larger portion of growing-stock volume is removed each year. In 1982, annual softwood removals represented 4.4 percent of the total softwood volume. By 1999, this had increased to 6.2 percent. The rate for hardwoods increased from 1.8 percent to 2.4 percent during the same time. This means that, over time, the removal and utilization of softwoods and hardwoods in relation to their current volumes has increased.

5.8.1 Removals by ownership

Removals of growing stock from public land have always been highly contentious, because opinions differ on the role that public land should play in providing timber products and the amount of harvesting that is sustainable. All ownerships except other public experienced an increase in removals between 1982 and 1999 (Figure 27). The removals on other public land fell from 247 MCF/yr to 209 MCF/yr. Average annual removals on NIPF land increased 36 percent (Table 23). Average annual removals on national forests grew 20 percent between 1982 and 1999, and peaked in 1989. Most of this increase occurred in the national forests in east Texas. Many of these removals are probably associated with salvage of dead trees after southern-pine beetle (*Dendroctonus frontalis* Zimm.) outbreaks in the early 1980's. In 1999, private land accounted for 64.5 percent of all growing-stock removals.

5.8.2 Forest type and removal trends

Just as oak-hickory dominates all other forest types in terms of growing-stock volume and growth, it also leads in average annual removals (Figure 28). Oak-hickory's average annual removal rate of 3,194 MCF/yr in 1999 represents 34 percent of all growing-stock removals (Table 24). In 1989, this forest type accounted for 30 percent of the removals. Oak-hickory and oak-pine combined have accounted for about half of all growing-stock removals.

Pine plantations accounted for approximately 19 percent of total growing-stock removals in both 1989 and 1999. These estimates are impressive considering that pine plantations accounted for only 6 percent of the total growing-stock volume in 1989, and 10 percent of that volume in 1999. Average annual removals in natural pine stands represent between 15 and 16 percent of total removals. Among forest types, only longleaf-slash pine stands experienced a decline in average annual removals between 1989 and 1999 for both natural and planted stands. Removals from planted longleaf-slash pine stands dropped from 394 MCF/yr to 376 MCF/yr. Natural longleaf-slash pine stands experienced a 6.1 percent drop in removals. Average annual removals from other forest types increased between 1989 and 1999:

Forest Type	Change in Removals (%)
White-red-jack pine	+129.8
Maple-beech-birch	+121.7
Oak-hickory	+42.8
Planted loblolly	+41.8
Oak-gum-cypress	+28.3

The large percentage changes in removal volumes for the white-red-jack pine and maple-beech-birch forest types can be attributed to the small area involved. Volumes and areas of these forest types are so small that any change in volume can produce a dramatic percentage change. The inclusion or removal of one plot in these forest types may produce large estimates of changes when expressed as a percentage.

5.9 Average annual mortality of growing stock

Average annual mortality is defined as the average annual sound-wood volume of growing-stock trees dying from natural causes between surveys. From 1953 to 1999, total growing-stock mortality went from 972 MCF/yr to 2,236 MCF/yr (Figure 29). Softwood mortality increased 310 percent during this time, while hardwood mortality rose only 2 percent.

In 1953 and 1963, softwoods accounted for two-thirds of total growing-stock mortality. In 1982 and 1989, average annual mortality rates for softwoods and hardwoods were nearly equal. In 1999, softwood mortality again exceeded hardwood mortality, but only by 10 percent (Table 25).

Investigation of the ratio of average annual mortality to standing volume reveals as interesting pattern. During the first two survey periods, both softwoods and hardwoods experienced

increases in this ratio (Figure 30). During the third survey period, the rate of morality decreased. Since then, hardwood and softwood mortality ratios have increased. The primary cause of this decline is most likely the amount of planting and timber management that was occurring in the late 1960's and early 1970's. Young, vigorous stands may experience low rates of mortality. However, if these stands are not actively managed, tree mortality may increase.

Causes of tree mortality are numerous and often difficult to identify. In 1999, diseases were responsible for 35 percent of all growing-stock mortality. Weather was the second greatest cause of tree mortality at 31 percent, followed by insects at 11 percent. The factor that had the greatest impact on average annual mortality was stand origin. Ninety-two percent of all growing-stock mortality occurred in natural stands. The other 8 percent occurred in planted stands. Loblolly and shortleaf pines accounted for 30 percent of the mortality volume in natural stands and 63 percent of the mortality volume in planted stands.

5.9.1 Ownership and average annual mortality

All ownerships experienced increased mortality, but forest industry experienced the lowest percentage increase (Figure 31). From 1953 to 1999, the average annual mortality almost doubled on industry land, going from 177.5 MCF/yr to 351 MCF/yr (Table 26). All other ownerships experienced a doubling of average annual mortality over the same time span. The biggest increases were on public land. One reason mortality is relatively low on forest industry land is that intensive management permits the harvest of many weak or diseased trees before they die. Mortality is unusually high on public land because long rotations tend to lead to higher mortality rates.

5.9.2 Average annual mortality by forest type

The oak-gum-cypress forest type has the highest average annual mortality rate of all forest types, accounting for close to one-third of total mortality volume (Figure 32 and Table 27). In 1989, the oak-gum-cypress forest type had an average annual mortality rate of 568.3 MCF/yr. In 1999, oak-gum-cypress accounted for 657.6 MCF/yr. The factor that best explains why oak-gum-cypress stands have such high mortality volumes is the lack of stand management. Many of these stands are not managed for timber production. Some are inaccessible or inoperable for logging due to frequent and long-term flooding. Thus dying trees are left to succumb to natural mortality.

Hardwood and mixed pine-hardwood stands were responsible for nearly all growing-stock mortality in 1989 and 1999. Hardwood stands accounted for 91 percent of all average annual growing-stock removals in 1989, and 90 percent in 1999. This may seem odd, as the mortality rates between hardwoods and softwoods are fairly even. The answer to this dilemma lies in the allocation of forest type. Softwood forest types are assigned to plots that have at least 50 percent of their growing stock volume in softwood species. Mixed pine-hardwood forest types are assigned to plots that have between 25 and 49 percent softwood growing stock. Hardwood forest types have less than 25 percent of their stocking in softwood species. Thus, hardwood as well as

pine-hardwood stands have softwood species in them. Many of these softwood trees die from natural causes.

5.10 Southwide growth-to-removals ratios

The ratio of growing stock removed annually to the amount of growth is a subject of great interest. A growth-to-removals (GR) ratio greater than one signifies that growth is exceeding removals. Conversely, a ratio of less than 1 denotes more volume is being removed than is being replaced by growth. For the past three survey cycles, GR ratios for both softwoods and hardwoods have decreased (Figure 33). In 1982, the GR ratios for both total growing stock and hardwood growing stock exceeded 1.5. The softwood GR ratio was at 1.4. By 1999, the GR ratio for all species was 1.05, indicating that growth and removals were virtually equal. Average annual growing-stock removals of softwoods exceeded growth in 1999. However, this is the first time that average annual softwood removals exceeded average annual growth. The implications of this information are widely debated. Many view removals exceeding growth as over-exploitation of the resource. Others think of this as a temporary fluctuation, as we are approaching a GR ratio of one, which represents stability between growth and removals.

It is important to remember that the growth and removals estimates in this Chapter are based on growing-stock trees. Any trees not meeting the minimum size requirement (5.0 inches d.b.h.) are excluded. Therefore, any interpretation of GR ratios should consider nonmerchantable trees and stands, and their impacts on future growth. In 1999, 14 percent of the South's timberland was in stands 0 to 7 years old (Table 10). Most of these stands are composed of submerchantable-sized trees. An additional 9 percent of the South's stands are 8 to 12 years age old. Many of these stands also have yet to reach merchantable status. Planted stands 0 to 12 years old account for 9 percent of the timber base. These stands have the potential to greatly affect future standing volume and average annual growth. These stands will contribute to future growth as the trees in these stands reach 5 inches d.b.h.

5.11 The effects of pine plantations on the South's forests

The long-term repercussions of southern pine plantations are subject to interpretation. These foresets increase the efficiency of timber production but also alter wildlife habitat.

The majority of plantation growing-stock volume is in softwoods. Of the 26,613.1 MCF of wood in plantations, 91 percent is softwood. In fact, 65 percent of the growing-stock volume in plantations is in the shortleaf-loblolly pine species group. Conversely, natural stands are composed of only 36 percent softwoods. Most of the South's hardwood volume, however, is in natural stands (Table 28).

How productive are southern pine plantations? The growth-to-volume ratio for plantation softwoods is 10.5 percent. It is derived by dividing the growth of plantation softwoods--2,544.6 MCF/yr--by the total softwood volume--24,234.1 MCF. The removals-to-volume ratio for plantations is 7.5 percent, while the mortality-to-volume ratio is 0.6 percent. Thus, plantations

grow 10.5 percent of their total growing-stock volume annually, while 7.5 percent is removed each year. In 1999, growth of plantation softwoods exceeded removals. Natural stands have a growth-to-volume ratio of 4.25 percent. The removals-to-volume ratio for natural softwoods is 5 percent, while the mortality-to-volume ratio is 1.1 percent. Currently, removals of softwood growing stock exceed growth of growing stock in natural stands. Plantations are responsible for 42.8 percent of all softwood growth in the South, despite the fact that they account for only 10.8 percent of the total growing-stock volume. Mortality is also higher in natural stands, probably because management is more intensive in plantations and weak or diseased trees are harvested in thinnings before they die.

Another topic that often creates heated discussion is the contrast in diameter distributions between natural stands and plantations. Natural stands have more volume due to the large amount of area they occupy. However, the diameter distributions of natural stands and planted stands differ considerably. In natural stands, the 11.0- to 12.9-inch diameter class has the greatest amount of volume (Figure 34). The diameter class with the greatest volume in planted stands is 7.0-8.9 inches. This is the size of chip-n-saw trees. From this point on, the curve drops. By the 17.0- to 18.9-inch class, little volume remains.

The general conclusions that can be formed from Table 28 and Figure 34 are that plantations are comprised mainly of softwoods, particularly loblolly and shortleaf pines. Plantations produce more growing-stock volume than natural stands in relation to the standing volume. Natural stands tend to have a greater variety of species, especially hardwoods, and have larger diameter distributions.

Rosson (1999) found similar results in a 30-year study of Arkansas and Mississippi. He used FIA data that covered three decades (four measurement periods) and over 2,500 plots per measurement period to investigate the effects of pine plantations on species richness and species evenness for an entire State. Species richness for the study was defined as the number of species found on a sample plot. The study showed that pine plantations had a notable impact on tree species richness at the State level. In this study, Arkansas plantations had 14.1 percent lower species richness and Mississippi plantations had 28.9 percent lower species richness than natural stands. Rosson reported that tree species richness declines as plantations replace harvested natural stands. Plots that had harvesting activity over the same study period experienced increases in tree species richness. Species richness on nonharvested plots increased 21.6 percent in Arkansas, and 43.8 percent in Mississippi over the 30-year period..

5.12 Southern forest ecosystems: Province ecological units

Framers of the Southern Forest Resource Assessment agreed to report results for ecological units as well as for more traditional units. The three higher levels of ecological units consist of Domain, Division, and Province (McNab and Avers 1994). The Province, which represents the regional scale, is the level at which FIA data are aggregated, analyzed, and discussed in this Chapter.

5.12.1 Distribution of timberland by Province and forest type

Portions of 11 Ecological Provinces occur in the South (Figure 35**)**. FIA data are organized by county, so it was not possible to follow Province boundaries exactly. Instead, each county was mapped into the Province that encompassed the greater portion of the county area.

The distribution of the South's timberland area by forest type and Province is shown in Figure 36 and Table 29. The largest forested Province in the South is the Southeastern Mixed Forest, which has 121 million acres of land, including 80 million acres of timberland. The Province extends from northern Virginia to eastern Texas and contains acreage of every major forest type in the South except spruce-fir, which is limited to the Central Appalachian Province. Oak-hickory forest types are the most abundant hardwoods and occupy 27 million acres or 34 percent of the timberland area in the Southeast Mixed Province. Nearly 1 out of every 3 acres of oak-hickory in the South are in this ecological unit. This Province also contains 28 million acres of loblolly-shortleaf pine--56 percent of the area of these forest types in the Southern region.

The South's Atlantic and Gulf Coasts comprise the Outer Coast Mixed Forest Province. Stretching from coastal Virginia to southern Louisiana and extreme eastern Texas, the 101 million acres in this ecological unit support 59 million acres of timberland. Forty-seven percent of the timberland in the Outer Coast Mixed unit is in pine types, including 13 million acres--92 percent--of the longleaf and slash pine forests found in the South. This unit also encompasses 15 million acres of loblolly-shortleaf pine. Primary hardwood forest types are oak, gum, and cypress, which occupy 14 million acres, nearly half of the oak-gum-cypress forests in the region.

The largest of the South's three mountain provinces is the Central Appalachian ecological unit with 23 million acres. As the name implies, this Province includes the Appalachian Mountains of northern Virginia south to northeast Georgia. Within its boundaries are 15 million acres of timberland, including all the primary forest types in the South except longleaf and slash pines. Most of the timberland in the Central Appalachian Province--10 million acres--is occupied by the oak-hickory type. Oak-pine forests account for 2 million acres, and maple-beech-birch stands occupy another 374,000 acres. Less than 10 percentof the area is in loblolly and shortleaf pine forest types. The white-red-jack forest type group occupy 543,000 acres in this Province. Although the type includes red and jack pines, white pine is the predominant species in the South.

5.12.2 Planted and natural pine and oak-pine stands by Province

In 1999, planted pine/oak-pine stands occupied 34 million acres throughout the South. Some 31 million acres were in the Southeast and Outer Coast Mixed Provinces (Figure 37 and Table 30). Planted stands account for nearly one-quarter of the timberland area in the two Provinces combined. Natural pine/oak-pine acres still outnumber the planted stands in these units, occupying 48 million acres. In the Southeast Mixed Province the ratio of natural to planted pine/oak-pine is 2-to-1. This is not the case for the Outer Coast, where there are just 1.1 acres of natural pine/oak-pine for every planted acre. Hardwoods occupy the remaining area in both units--59 million acres.

Planted pine/oak-pine stands are a minor component in the other Provinces, except for the Ouachita Mixed unit, where they occupy 1 million of the 4 million acres of timberland. The 3 million acres that make up the rest of the Province are split evenly between natural pine/oak-pine, and hardwood forest types.

5.12.3 Distribution of timberland by Province and ownership

Timberland ownership by Ecological Province is shown in Figure 38 and Table 31. As the map illustrates, timberland owned by private individuals is well represented in each of the 11 Provinces. Individuals control more than half the timberland acres in all but two Provinces, and own as much as 82 percent of the Eastern Broadleaf Forest (Continental) unit, and 85 percent of the Everglades Province. The two units where private individuals own less than half of the timberland are the Outer Coast Mixed Forest Province--48 percent --and the Ouachita Mixed Forest Province--30 percent.

Forest industry and corporate ownerships are concentrated in the Outer Coast Mixed and Southeast Mixed Provinces, as are national forest and other public timberlands. Industry ownership in the two units combined totals 34 million acres, which is 86 percent of all industry timberland in the South. Seventy percent of all corporate timberland--13 million acres--is in these Provinces.

National forest timberland in the Outer Coast and Southeast Mixed Provinces combined, amounts to 5 million acres, or 47 percent of the national forest timberland in the South. Another 28 percent, or 3 million acres of national forest land is in the Central Appalachian Province. This Province contains the George Washington and Jefferson National Forests in Virginia, and major portions of the Pisgah and Nantahala National Forests in North Carolina. Corporations control about 2 million acres in the Central Appalachian Province.

5.12.4 Live tree volume on timberland by Province

Hardwood live tree volume density is shown in Figure 39. This map illustrates that the Appalachian, Smokey, and Ozark Mountain Ranges have the highest hardwood densities in the South. Conversely, the Mississippi Delta, south Florida everglades, and the extreme western edge of the survey range have little hardwood volume. These areas also have little softwood volume (Figure 40). Additionally, the Eastern Broadleaf Forest (Continental) and parts of the Appalachian Mountain units have low softwood densities. Softwood volume also is low in the Blackland Prairie, which runs through Alabama and Mississippi. The highest softwood densities are in central Louisiana and southern Arkansas, as well as the northwestern edge of the Outer Coast Mixed Province.

Investigating total volume by province reveals the relationship between area and volume. The Southern Mixed and Outer Coast Mixed Provinces contain a majority of timberland area and volume. The Southern Mixed Province has 40 percent of the timberland area and 41 percent of the total growing-stock volume (Table 32).

5.12.5 Average net annual growth and removals of live timber by Province

The Southeast Mixed Province dominates the South in net annual growth and removals of live trees (Table 33). This Province, which accounts for 40 percent of the total timberland area in the South, is responsible for 50 percent of the South's average net annual growth and 59 percent of its average net annual removals. The Southeast Mixed and Outer Coast Mixed Provinces are the only two in which softwood removals exceed growth. With the exception of the Everglades, growth exceeds or equals removals for both softwood and hardwood species in all other Provinces.

5.13 FIA procedures

This section describes the inventory procedures used to collect forest resource data in Southern States. Dates of surveys for each State are in Section 4.3. Inventory procedures between 1972 and 1995 differed slightly from procedures in 1997 through 1999. Descriptions of both methods follow.

5.13.1 Inventories procedures between 1972 and 1995

Estimates of forest and nonforest areas were based on the ground classification of sample clusters systematically spaced on the most recent aerial photographs. A subsample of 16-point clusters was ground-checked, and a linear regression was fitted to the data to develop the relationship between the photo and ground classification of the subsample. This procedure provided a means for adjusting initial estimates of area for changes in land use since date of photography and for errors in photo interpretation.

Estimates of timber volume and forest classification were based on measurements recorded at ground-sample locations systematically distributed on timberland. The plot design at each location was based on a cluster of 10 points. In most cases, variable plots, established by using a basal-area factor of 37.5 square feet per acre, were systematically spaced in a single forest condition at 5 of the 10 cluster points. Trees less than 5 inches d.b.h. were tallied on a fixed-radius plot at the center of each point.

Equations prepared from detailed measurements collected on standing trees in each State, and similar measurements taken throughout the Southeast, were used to compute the volume of individual tally trees. A mirror caliper and sectional aluminum poles were used to obtain the additional measurements required to construct volume equations. Forest biomass was estimated with equations developed by the Ecology and Genetics of Southern Pine Ecosystems Research Work Unit of the SRS in Athens, GA. In addition, felled trees were measured at several active cutting operations in each State to provide utilization factors for the different timber products and species groups, and to supplement the standing-tree volume study.

In each State, growth, removals, and mortality were estimated from the remeasurement of permanent sample plots established at the time of the previous inventory. Periodic surveys of

timber products output conducted in cooperation with State agencies, along with the annual pulpwood production study for the South, provided additional information for breakdowns of removals by product.

Ownership information was collected from correspondence, public records, and local contacts in each Southern State. In counties where the sample missed a particular ownership class, temporary samples were added and measured to describe forest conditions in the ownership class.

All field data were sent to the FIA Unit in Asheville, NC, or Starkville, MS, for editing and were stored for processing. Final estimates were based on statistical summaries of the data.

5.13.2 Inventory methods for Georgia (1997) and Tennessee (1999)

The SRS-FIA unit currently uses a two-phase sample of aerial-photo points and permanent ground plots. The area of forest land in each county is determined by interpreting aerial-photo point clusters. Initial estimates of forest and nonforest land are based on the classification of sample clusters systematically spaced on the most recent aerial photographs. A subsample of the photo clusters is ground-checked so initial area estimates can be adjusted for changes in land use since the date of photography and for errors in photo interpretation.

The plot design at each ground sample location is based on a cluster of four points spaced 120 feet apart. Each point is the center of a 1/24-acre circular subplot used to sample trees 5.0 inches d.b.h. and larger. A 1/300-acre circular microplot, located at the center of the subplot, is used to sample trees 1.0 through 4.9 inches d.b.h. and seedlings (trees less than 1.0 inch d.b.h.). These fixed-radius sample plots are located without regard to land use or forest cover. Forest and nonforest condition classes are delineated and recorded. Condition classes are defined by six attributes: land use, forest type, stand origin, stand size, stand density, and major ownership category. All trees tallied were assigned to their respective condition class.

Estimates of timber volume and forest classification are derived from tree measurements and classifications made at the ground sample locations. Volumes for individual tally trees are computed using equations for each of the major species in the State. The equations were developed from detailed measurements collected on standing trees in each State and throughout the region.

Growth, removals, and mortality are estimated from the remeasurement of permanent sample plots established in the previous inventory. Plot design for the previous inventory has already been described.

6 Conclusions

The South's forests of today are drastically different from those present 100 or 200 years ago, and they continue to change. Human impacts from centuries of use have forever changed the

character and extent of the South's forests. The absence of fire, combined with extensive logging and agricultural practices resulted in the loss of vast expanses of open park-like stands of timber. By 1900, the South's landscape was composed of cutover woodlands and highly eroded farmlands. Decades of abuse led to massive soil erosion in many parts of the South, leaving the land less productive and watersheds clogged with sediments. When the timber industry moved to the South in 1880 the harvest of trees on a large scale ensued. In less than 50 years, entire ecosystems were radically changed, some to the edge of destruction. By 1920, 55 million acres had been logged, and less than half supported regeneration. Only one-third of the South's forested area remained.

The story of recovery from this low point in the history of land use in the South is often overlooked. The conservation movement helped preserve some of the remaining forest land through the creation of parks, nature preserves, and other protected areas. State forest management agencies were formed, and legislation passed that created the National Forest System in the East. The Civilian Conservation Corps (CCC) of the 1930's, and the Soil Bank program of the 1950's and early 1960's, played a large role in the regeneration of southern forests. Between 1938 and 1963, the area of forest land in the South rose by 7 million acres due in no small part to these and similar Federal efforts. In spite of past abuses of the land, and the increased pressures over the past 100 years to provide more, southern forests today are a diverse mosaic of pine plantations, hardwood stands, and mixed pine-hardwood forests.

Many of the benefits derived from southern forests today are the result of these early reforestation efforts. Total forested area, growing-stock volume, and average annual growth and removals increased rapidly between the 1930's and 1950's. Between 1953 and 1999, total hardwood growing-stock volume increased 72 percent, while softwood growing-stock volume increased 73 percent. Average annual growth and removals of growing-stock also increased during this time. From 1982 to 1999, average annual removals of growingstock increased 52 percent. Throughout this period, growth exceeded removals. It is only recently that average annual removals of softwood growingstock have exceeded average annual growth.

Forest land under private ownership has been impacted the most by plantation forestry, and likely will continue to be in the foreseeable future. In 1952, pine plantations occupied less than 2 million acres in the South, while natural pine existed on 72 million acres. By 1999, the 30 million acres of pine plantations in the South nearly equaled the 34 million acres of natural pine.

The increase in acres of planted pine is seen as a double-edged sword. Those opposed to plantations believe these acres to be little more than cropland--"false forests" or "biological deserts" lacking the diversity and species richness of natural stands. FIA data indicate that pine plantations caused a decrease in species richness over a 30-year period in two Southern States (Rosson 1999). Those who favor pine plantations see them as a means of regenerating harvested sites more efficiently, and producing wood at faster rates than in natural stands. In 1999, pine plantations occupied only 16 percent of the South's timberland area, but these acres provided 43 percent of all softwood growth, and 35 percent of all softwood removals.

Urbanization and, to a lesser extent, agriculture pose the greatest threats to further loss of forest land in the South. As urbanization and agriculture remove additional acres from the timber

base, timber resource managers must strive to retain as many acres as possible in a forested condition. With each successive inventory, FIA data indicate that pine plantations play an ever-increasing role in meeting the South's increased demand for forest products. Future population increases could result in even greater expansion of pine plantations needed to replace forest land lost to other uses, and to keep pace with increased demand.

7 Needs for Additional Research

The South's forests have changed a great deal in the past and they are changing now. SRS-FIA attempts to measure and assess these changes. It is tasked with researching, analyzing, and reporting the extent and condition of southern forests. SRS-FIA is constantly evaluating new inventory procedures and methods and implementing those that will better detect and describe change in the South's forested ecosystems. Many of these new procedures are currently being developed.

The greatest change that is currently underway involves the transition from periodic to annual surveys. Traditionally, FIA units have surveyed each State in their regions at intervals of 8 to 12 years. These periodic surveys detected changes between inventories, but the timing often was less than optimal. Up-to-date information is necessary to accurately address rising resource issues or to determine the extent of damage from catastrophic events such as hurricanes or fires. In some instances, interim surveys were needed to update older information. In addition, the breadth and depth of the analyses described in this Chapter was limited due to a lack of timely FIA data covering all Southern States. To address these shortcomings, FIA is developing a system that will provide annual updates.

Historically, FIA has concentrated almost exclusively on timberland and timber products. While timber remains a primary focus for FIA, other forest resources need to be better sampled to completely assess the nation's forests and rangelands. Cooperative efforts among FIA, and fish and wildlife, outdoor recreation, and wilderness SRS units, and other resource agencies at the Federal and State level are needed to identify specific data needs and to coordinate and support the collection of this additional inventory information. As an example, USDA Forest Service Forest Health Monitoring (FHM) investigates tree pests, pathogens, understory vegetation and other components and indicators of total forest ecosystem health. The FHM data collection procedures are being integrated with those of FIA to streamline methods and to measure additional biological indicators of the health of the South's forested ecosystems.

FIA and other SRS scientists, and university researchers, need to be more involved in designing methods and identifying variables to assess wildlife habitat, identify recreational potential, and sample a wider array of nontimber products currently being utilized from the South's forests. FIA has recently adopted a fixed-area, mapped-plot sample design making it possible to better assess the relationships between wildlife and the effects of stand edge, density, size, and age.

Perhaps the most urgent need is the development of new remote sensing technologies that provide current satellite or other imagery compatible with large-scale inventories. Photographic coverage of forest area used by FIA is often dated. Up-to-date imagery of the South's forests is

critical for accurately estimating forest cover and improving the detection and assessment of disturbance.

These changes will not come without costs. New sampling procedures may complicate, or even prevent, the detection of trends. Since the 1930's, southern forest inventories have gone from surveys based on strip cruises, to fixed-area plots, to variable radius sampling, to a mapped-plot design. Much of the data in this Chapter utilizes information obtained from these differing methods. With each change, the possibility for masking actual resource trends increases. However, these costs are justified where utilizing the latest methods and technology will better position FIA to meet future needs.

8 Acknowledgments

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10 Tables and Figures

Table 1--Area of forest land by State and year, Southern United States

State	1630[a]	1907[a]	1938[a]	1953[a]	1963[a]	1982[b]	1989[c]	1999[d]
				Thousand acres				
Alabama	29,540	20,000	18,878	20,771	21,770	21,375	21,725	21,965
Arkansas	31,940	24,200	20,963	19,681	20,051	17,139	17,687	18,790
Florida	29,840	24,128	21,740	20,817	19,050	17,134	16,549	16,221
Georgia	35,700	22,300	21,433	24,057	26,365	24,243	24,137	24,413
Kentucky	23,140	10,000	11,546	11,647	11,791	12,161	12,256	12,699
Louisiana	26,160	16,500	16,211	16,230	16,176	14,529	13,883	13,792
Mississippi	26,700	17,500	16,253	16,890	17,076	16,716	16,993	18,595
North Carolina	29,630	19,600	18,400	20,113	20,662	20,025	18,953	19,278
Oklahoma	13,330	10,500	10,415	10,329	9,235	8,513	7,283	7,665
South Carolina	17,570	12,000	10,704	11,943	12,250	12,575	12,257	12,646
Tennessee	24,010	15,000	13,000	12,808	13,629	13,360	13,603	14,405
Texas	41,980	30,000	26,949	24,708	23,954	23,279	20,505	18,354
Virginia	24,480	14,000	14,832	16,032	16,412	16,417	15,968	16,027
Total	354,020	235,728	221,324	226,026	228,421	217,465	211,799	214,848

Numbers in columns may not sum to totals due to rounding

a Data from Smith and others 2001.

b Data for 1982 are based on FIA inventories conducted between 1972 and 1982, except for Kentucky, Oklahoma, and Texas. Data for these three States are taken from Smith and others 2001.

c Data for 1989 are based on inventories conducted by FIA between 1982 and 1989, except for Kentucky, Oklahoma, and Texas. Data for these three States are taken from Smith and others 2001.

d Data for 1999 are based on FIA inventories conducted between 1990 and 1999, except for Oklahoma and Texas. Data for these two States are taken from Smith and others 2001.

Return to first reference in text

Table 2--Area of timberland by State, ownership class, and year, Southern United States

State	Year[a]	All owner-ships	Public				Private				
			Totai public	Federal			State	County and Muni cipal	Total private	Forest industry	Non- industrial Private
				Total Federal	National forest	Other					
			Thousand acres								
Alabama	1953	20,756	968	791	616	175	150	27	19,788	3,138	16,650
	1963	21,744	1,003	800	630	170	157	46	20,741	3,818	16,923
	1982	21,358	1,003	812	626	186	140	51	20,355	4,204	16,151
	1989	21,659	1,160	950	689	262	147	63	20,498	4,464	16,034
	1999	21,932	1,162	855	605	250	212	95	20,770	4,795	15,975
Arkansas	1953	19,627	2,916	2,799	2,292	507	115	2	16,711	4,157	12,554
	1963	19,971	2,856	2,651	2,385	266	194	11	17,115	4,007	13,108
	1982	16,707	3,011	2,659	2,329	330	311	41	13,696	4,258	9,438
	1989	17,245	3,077	2,679	2,298	382	342	55	14,168	4,364	9,804
	1999	18,392	3,296	2,835	2,372	463	394	67	15,096	4,497	10,599
Florida	1953	18,135	2,215	1,777	1,035	742	382	56	15,920	4,369	11,551

	1963	16,830	2,201	1,621	1,030	591	540	40	14,629	4,767	9,862
	1982	15,664	2,179	1,596	1,006	590	542	41	13,486	4,697	8,789
	1989	14,983	2,443	1,570	990	580	814	59	12,540	4,770	7,770
	1999	14,651	2,832	1,616	1,030	587	1,138	78	11,819	4,016	7,804
Georgia	1953	23,969	1,685	1,560	644	916	102	23	22,284	4,246	18,038
	1963	26,298	1,813	1,678	746	932	111	24	24,485	4,068	20,417
	1982	23,734	1,584	1,396	765	631	118	70	22,150	4,964	17,186
	1989	23,631	1,645	1,371	752	620	186	88	21,986	4,990	16,995
	1999	23,796	1,751	1,380	711	669	260	112	22,045	4,381	17,664
Kentucky	1953	11,497	725	672	455	217	53	0	10,772	308	10,464
	1963	11,651	652	575	438	137	77	0	10,999	308	10,691
	1982	11,902	896	819	589	230	76	1	11,007	255	10,752
	1989	11,909	890	856	583	273	34	0	11,019	205	10,814
	1999	12,347	1,004	863	628	235	141	0	11,344	205	11,139
Louisiana	1953	16,039	848	666	535	131	177	5	15,191	3,166	12,025
	1963	16,036	883	704	575	129	174	5	15,153	3,032	12,121
	1982	14,518	1,183	772	640	132	405	6	13,335	3,770	9,565

	1989	13,873	1,325	828	615	212	330	168	12,547	3,603	8,944
	1999	13,783	1,311	804	569	235	300	207	12,472	3,898	8,573
Mississippi	1953	16,853	1,709	1,235	1,036	199	54	420	15,144	2,461	12,683
	1963	17,044	1,708	1,255	1,109	146	55	398	15,336	2,526	12,810
	1982	16,685	1,751	1,516	1,258	258	112	123	14,934	3,029	11,905
	1989	16,987	1,950	1,581	1,218	363	253	116	15,037	3,200	11,838
	1999	18,587	1,951	1,541	1,107	435	310	100	16,636	3,238	13,398
North Carolina	1953	19,584	1,541	1,252	1,020	232	253	36	18,043	2,584	15,459
	1963	19,989	1,663	1,290	1,033	257	307	66	18,326	2,495	15,831
	1982	19,545	1,745	1,347	1,011	336	320	78	17,800	2,135	15,665
	1989	18,450	1,922	1,509	1,117	393	332	80	16,529	2,337	14,191
	1999	18,710	2,003	1,572	1,082	490	347	84	16,708	2,252	14,456
Oklahoma	1953	5,075	494	309	213	96	185	0	4,581	889	3,692
	1963	4,892	427	291	223	68	136	0	4,465	865	3,600
	1982	4,316	478	356	196	160	116	6	3,837	967	2,870
	1989	4,741	628	508	243	265	114	6	4,114	1,046	3,068
	1999	4,895	637	498	223	275	118	21	4,259	1,047	3,212

South Carolina	1953	11,884	955	802	563	239	128	25	10,929	1,650	9,279
	1963	12,171	1,034	858	564	294	153	23	11,137	2,010	9,127
	1982	12,503	1,091	901	579	322	167	23	11,413	2,243	9,170
	1989	12,179	1,173	913	577	337	233	27	11,006	2,626	8,379
	1999	12,455	1,114	904	560	344	177	33	11,341	2,322	9,019
Tennessee	1953	12,551	1,114	806	564	242	298	10	11,437	713	10,724
	1963	13,365	1,199	834	591	243	344	21	12,166	923	11,243
	1982	12,959	1,375	966	585	381	379	30	11,585	1,226	10,359
	1989	13,265	1,509	1,027	556	471	422	59	11,756	1,122	10,635
	1999	13,965	1,568	981	557	424	519	69	12,397	1,393	11,004
Texas	1953	13,081	782	745	654	91	35	2	12,299	3,019	9,280
	1963	12,960	832	780	623	157	50	2	12,128	3,362	8,766
	1982	11,662	843	774	661	113	52	17	10,820	3,835	6,985
	1989	11,565	769	700	610	90	57	12	10,797	3,796	7,001
	1999	11,774	790	675	577	98	68	47	10,985	3,720	7,265
Virginia	1953	15,497	1,493	1,355	1,198	157	86	52	14,004	1,095	12,909
	1963	15,753	1,535	1,395	1,203	192	88	52	14,218	1,454	12,764

	1982	15,973	1,956	1,704	1,458	246	183	69	14,017	1,670	12,347
	1989	15,436	1,994	1,708	1,487	221	209	77	13,442	1,834	11,608
	1999	15,448	1,983	1,689	1,468	221	211	83	13,464	1,537	11,927
Total	1953	204,548	17,445	14,769	10,825	3,944	2,018	658	187,103	31,795	155,308
	1963	208,704	17,806	14,732	11,150	3,582	2,386	688	190,898	33,635	157,263
	1982	197,527	19,095	15,618	11,703	3,915	2,921	556	178,433	37,251	141,182
	1989	195,923	20,485	16,202	11,734	4,468	3,473	810	175,438	38,356	137,082
	1999	200,736	21,401	16,211	11,487	4,724	4,195	995	179,335	37,301	142,034

Numbers in rows and columns may not sum to totals due to rounding.

a Data for 1982, 1989 and 1999 (except for Kentucky) are based on FIA inventories conducted between 1972-1982, 1982–1989 and 1990–1999, respectively. All data for Kentucky are taken from Smith and others 2001, as are data for years 1963, and 1953.

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Table 3--National forests by State, date established, original NFS acreage, and current NFS acreage, Southern United States

National forests by State	Date established	Original NFS acreage[a]	Current NFS acreage[a]
		Acres	
Alabama			
Conecuh NF	7/17/1936	83,957	83,858
Talladega NF	8/31/1936	364,428	389,328
Tuskegee NF	11/27/1959	10,778	11,252
William B. Bankhead NF	1/15/1918	179,294	180,548
Total		638,457	664,986
Arkansas			
Ouachita NF[c]	12/18/1907	1,330,450	1,423,459
Ozark NF	3/6/1908	1,109,317	1,136,709
St. Francis NF	11/18/1960	20,946	21,201
Total		2,460,713	2,581,369
Florida			
Apalachicola NF	5/13/1936	557,729	565,543
Choctawhatchee NF	11/27/1908	1,152	1,152
Ocala NF	11/24/1908	367,204	383,573
Osceola NF	7/10/1931	157,230	158,255
Total		1,083,315	1,108,523
Georgia			

Chattahoochee NF	7/9/1936	741,279	749,352
Oconee NF	11/27/1959	104,511	115,231
Total		845,790	864,583
Kentucky			
Daniel Boone NF	2/23/1937	520,038	547,686
Jefferson NF[c]	4/21/1936	961	961
Total		520,999	548,647
Louisiana			
Kisatchie NF	6/10/1930	595,589	603,230
Total		595,589	603,230
Mississippi			
Bienville NF	6/15/1936	177,077	178,542
De Soto NF	6/17/1936	500,156	506,028
Delta NF	1/12/1937	59,159	60,015
Holly Springs NF	6/15/1936	145,141	155,661
Homochitto NF	7/20/1936	189,039	191,505
Tombigbee NF	11/27/1959	65,412	66,874
Total		1,135,984	1,158,625
North Carolina			
Cherokee NF[c]	7/14/1920	327	327
Croatan NF	7/29/1936	156,589	159,886
Nantahala NF	1/29/1920	457,772	527,709
Pisgah NF	10/17/1916	483,154	505,420
Uwharrie NF	1/12/1961	45,760	50,189

Total		1,143,602	1,243,531
Oklahoma			
Ouachita NF[c]	12/18/1907	244,489	350,845
Total		244,489	350,845
South Carolina			
Francis Marion NF	7/10/1936	249,406	252,288
Sumter NF	7/13/1936	357,599	360,868
Total		607,005	613,156
Tennessee			
Cherokee NF[c]	7/14/1920	618,494	634,198
Total		618,494	634,198
Texas			
Angelina NF	10/13/1936	155,293	153,180
Davy Crockett NF	10/13/1936	161,478	160,652
Sabine NF	10/13/1936	187,191	160,656
Sam Houston NF	10/13/1936	158,648	162,996
Total		662,610	637,484
Virginia			
George Washington NF[c]	5/16/1918	940,352	960,133
Jefferson NF[c]	4/21/1936	656,530	700,268
Total		1,596,882	1,660,401
Total all states		12,153,929	12,669,578

Numbers in columns may not sum to totals due to rounding.

a Shands and Healy 1977.

b USDA Forest Service 2000.

c Unit is in two or more States.

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Table 4--Area of nonindustrial private timberland by State, survey date, forested tract-size class, and forest management type

State, survey date, and forested tract-size class	Forest-management type						
	All types	Pine plantation	Natural pine	Oak- pine	Upland hardwood	Lowland hardwood	Nonstocked
Acres	Thousand acres						
Florida 1995							
≤ 10	1,059	85	146	63	105	132	529
11–50	1,498	279	239	143	172	218	447
51–100	928	185	109	49	105	179	301
101–200	1,118	321	109	76	93	204	316
201–500	1,269	319	160	72	87	288	344
≥ 501	1,345	413	148	74	51	262	396
Total	7,217	1,602	910	476	613	1,283	2,333
Georgia 1997							
≤ 10	1,187	41	370	201	483	75	17
11–50	2,417	218	622	416	830	283	47

51–100	2,412	298	532	414	720	402	46
101–200	3,365	672	624	525	962	532	51
201–500	4,021	935	757	645	874	758	52
≥ 501	3,754	1,068	678	595	695	668	50
Total	17,155	3,232	3,584	2,795	4,563	2,719	262
South Carolina 1993							
≤ 10	891	30	195	108	277	109	171
11–50	2,217	176	476	360	512	339	355
51–100	1,610	271	363	230	262	245	239
101–200	1,469	251	326	217	267	203	205
201–500	1,305	241	305	186	149	243	181
≥ 501	1,456	241	365	169	159	276	246
Total	8,947	1,210	2,031	1,269	1,626	1,415	1,395
Tennessee 1999							
≤ 10	877	29	115	102	579	45	8
11–50	2,264	15	200	302	1,641	85	22
51–100	2,292	45	121	296	1,661	148	21

101–200	2,316	19	112	249	1,741	177	19
201–500	1,821	15	141	217	1,314	123	11
≥ 501	1,433	48	101	131	1,051	98	5
Total	11,004	171	789	1,297	7,986	675	86
Virginia 1992							
≤ 10	1,276	49	240	124	659	48	155
11–50	3,496	150	488	361	2,008	72	416
51–100	2,617	159	304	342	1,395	82	336
101–200	2,052	193	204	259	1,017	115	264
201–500	1,500	145	128	168	806	71	182
≥ 501	969	61	61	98	543	56	150
Total	11,910	757	1,427	1,350	6,428	445	1,503
Total all States							
≤ 10	5,289	234	1,066	597	2,103	409	879
11–50	11,891	838	2,026	1,581	5,162	997	1,287
51–100	9,859	958	1,429	1,330	4,143	1,056	942
101–200	10,319	1,456	1,374	1,325	4,079	1,231	855

201–500	9,917	1,655	1,492	1,287	3,230	1,482	770
≥ 501	8,957	1,831	1,353	1,066	2,498	1,361	847
Total	56,232	6,972	8,741	7,187	21,215	6,537	5,580

Numbers in rows and columns may not sum to totals due to rounding.

Source: Thompson 1999, Thompson 1997, and Thompson and Johnson 1996.

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Table 5--Area of timberland by year and forest-type group, Southern United States

		Forest-type group									
Year[a]	All groups	White-red-jack pine	Spruce- fir	Longleaf- slash pine	Loblolly-shortleaf- pine	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Non-Stocked
	Thousand acres										
1953	204,546	329	12	26,926	51,792	23,970	54,872	34,498	4,051	750	7,346
1963	208,703	439	15	24,902	52,201	24,310	61,801	34,747	3,461	566	6,261
1982	197,525	453	8	15,926	47,766	29,556	67,752	27,613	3,082	996	4,374
1989	195,916	551	19	14,594	46,277	27,964	72,534	26,724	2,868	877	3,510
1999	200,736	688	13	13,176	49,797	29,875	74,027	28,093	2,533	1,015	1,522

Numbers in rows may not sum to totals due to rounding.

a Except for Kentucky, data for 1982, 1989, and 1999 are based on FIA inventories conducted between 1972-1982, 1982-1989, and 1990-1999, respectively. Kentucky data for 1999 are from the 1988 FIA survey, and data for both the 1982 and 1989 reporting years are from the 1975 FIA survey of Kentucky. Data for 1963 and 1953 are taken from Smith and others (2001).

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Table 6--Area of timberland by State, year, and forest-type group, Southern United States

State	Year[a]	All groups	Forest-type group								
			White-red-jack pine	Longleaf- slash	Loblolly-shortleaf	Oak-pine	Oak- hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Non-stocked
			Thousand acres								
Alabama	1982	21,358	—	1,512	6,499	5,081	5,650	2,479	23	—	114
	1989	21,659	—	1,409	5,819	4,426	7,415	2,456	40	—	95
	1999	21,932	5	1,187	6,255	4,522	7,650	2,253	16	—	44
Arkansas	1982	16,707	—	—	4,304	2,995	6,568	2,681	144	—	16
	1989	17,245	—	—	4,192	3,039	7,269	2,575	158	—	11
	1999	18,392	—	—	5,077	3,137	7,127	2,791	227	—	32
Florida	1982	15,664	—	6,024	1,163	1,320	1,240	3,846	61	—	2,011
	1989	14,983	—	5,743	1,330	1,116	1,114	3,826	84	—	1,772
	1999	14,651	—	5,621	1,554	1,463	1,981	3,562	42	—	428
Georgia	1982	23,734	81	4,595	6,557	2,922	5,448	2,990	447	—	694
	1989	23,631	74	4,048	6,794	3,048	5,582	3,109	312	—	663

	1999	23,796	85	3,403	7,153	3,567	5,421	3,555	222	1	390
Kentucky	1982	11,902	14	—	679	800	9,169	82	628	514	15
	1989	11,902	14	—	679	800	9,169	82	628	514	15
	1999	12,347	37	—	646	858	9,516	59	571	661	—
Louisiana	1982	14,518	—	988	4,069	2,169	1,680	4,897	395	—	319
	1989	13,873	—	927	4,049	1,897	2,165	4,337	409	—	89
	1999	13,783	—	864	4,143	1,887	2,079	4,345	396	—	70
Mississippi	1982	16,685	—	1,034	4,210	3,434	4,310	,391	131	—	175
	1989	16,987	—	854	3,939	3,470	5,508	3,040	134	—	42
	1999	18,588	—	866	4,885	3,218	5,834	3,561	151	—	73
North Carolina[b]	1982	19,545	151	532	6,046	2,484	7,034	2,171	425	214	488
	1989	18,450	223	571	5,446	2,252	6,844	2,244	385	158	328
	1999	18,710	246	411	5,538	2,568	6,975	2,453	172	194	153
Oklahoma	1982	4,316	—	—	814	704	2,369	331	93	—	6
	1989	4,741	—	—	956	747	2,600	360	78	—	—
	1999	4,895	—	—	1,099	702	2,591	410	94	—	—
South Carolina	1982	12,503	13	970	4,538	1,716	2,760	1,961	273	—	273
	1989	12,179	11	763	4,619	1,533	2,482	2,250	248	—	274

	1999	12,455	12	592	4,915	1,893	2,483	2,372	96	—	92
Tennessee	1982	12,959	50	—	1,303	1,422	9,259	757	32	137	—
	1989	13,265	64	—	1,334	1,592	9,477	639	43	111	6
	1999	13,965	104	—	1,365	1,625	9,911	609	241	16	94
Texas	1982	11,662	—	271	4,334	2,591	2,672	1,679	104	—	12
	1989	11,565	—	280	3,976	2,365	3,351	1,508	59	11	17
	1999	11,774	—	232	4,065	2,502	3,127	1,741	65	—	42
Virginia	1982	15,973	152	—	3,250	1,921	9,594	348	325	130	252
	1989	15,436	183	—	3,145	1,682	9,559	296	290	83	198
	1999	15,448	212	—	3,104	1,932	9,332	383	239	142	104
All States	1982	197,525	461	15,926	47,766	29,556	67,752	27,613	3,082	996	4,374
	1989	195,916	570	14,594	46,277	27,964	72,534	26,724	2,868	877	3,510
	1999	200,736	701	13,176	49,797	29,875	74,027	28,093	2,533	1,015	1,522

Numbers in rows and columns may not sum to totals due to rounding.

a Except for Kentucky, data for 1982, 1989, and 1999 are based on FIA surveys conducted between 1972-1982, 1982-1989, and 1990-1999, respectively. Kentucky data for 1999 are from the 1988 FIA survey, data for both the 1982 and 1989 reporting years are from the 1975 FIA survey of Kentucky.

b Estimates of white-red-jack pine in North Carolina include 7.9, 18.5, and 13.1 million acres of spruce-fir forest type for years 1982, 1989, and 1999, respectively.

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Table 7--Area of timberland by State, year, and stand-size class for softwood and hardwood, Southern United States

State	Year[a]	All classes	Stand-size class						
			Sawtimber		Poletimber		Sapling-seedling		
			Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Nonstocked
		Thousand acres							
Alabama	1982	21,358	2,930	3,945	2,706	4,514	2,376	4,774	114
	1989	21,659	2,985	4,593	2,042	4,334	2,201	5,409	95
	1999	21,932	2,587	5,053	2,139	3,773	2,722	5,615	44
Arkansas	1982	16,707	2,467	4,892	934	4,429	903	3,066	16
	1989	17,245	2,149	5,206	920	4,158	1,123	3,678	11
	1999	18,392	2,652	5,887	1,319	4,133	1,107	3,263	32
Florida	1982	15,664	1,946	3,020	2,409	1,711	2,832	1,735	2,011
	1989	14,983	1,833	3,094	2,330	1,553	2,909	1,492	1,772
	1999	14,651	1,655	3,132	2,437	1,587	3,083	2,330	428
Georgia	1982	23,734	4,444	5,065	3,769	3,953	3,020	2,790	694

	1989	23,631	3,946	5,340	3,038	3,257	3,934	3,455	663
	1999	23,796	3,569	6,044	3,253	2,390	3,818	4,333	390
Kentucky	1982	11,902	242	5,042	89	2,763	362	3,389	15
	1989	11,902	242	5,042	89	2,763	362	3,389	15
	1999	12,347	294	6,829	203	2,994	185	1,843	—
Louisiana	1982	14,518	2,719	5,144	1,322	2,108	1,016	1,889	319
	1989	13,873	2,881	5,172	961	1,557	1,134	2,079	89
	1999	13,783	2,681	5,468	957	1,205	1,370	2,034	70
Mississippi	1982	16,685	2,574	4,844	1,451	3,199	1,219	3,223	175
	1989	16,987	2,386	5,369	1,046	2,696	1,361	4,087	42
	1999	18,588	2,129	5,618	1,474	2,299	2,149	4,847	73
North Carolina	1982	19,545	2,268	5,944	2,181	4,111	2,280	2,273	488
	1989	18,450	2,576	6,403	2,049	3,238	1,615	2,242	328
	1999	18,710	2,586	6,531	2,061	2,878	1,548	2,953	153
Oklahoma	1982	4,316	349	868	245	1,274	221	1,354	6
	1989	4,741	392	905	221	1,422	343	1,458	—
	1999	4,895	392	1,105	530	1,474	176	1,218	—

South Carolina	1982	12,503	2,309	3,145	1,762	1,791	1,450	1,773	273
	1989	2,179	2,382	3,129	1,359	1,727	1,651	1,657	274
	1999	12,455	1,954	2,811	1,468	1,670	2,097	2,364	92
Tennessee	1982	12,960	439	4,884	519	4,510	394	2,213	—
	1989	13,265	596	5,926	471	3,926	331	2,010	6
	1999	13,965	622	6,569	359	3,099	488	2,734	94
Texas	1982	11,662	2,810	3,356	937	1,868	857	1,822	12
	1989	11,565	2,511	3,217	786	1,661	958	2,415	17
	1999	11,774	2,069	3,199	1,040	1,549	1,188	2,688	42
Virginia	1982	15,973	975	5,381	1,259	4,746	1,168	2,193	252
	1989	15,436	1,060	6,269	1,326	3,777	942	1,864	198
	1999	15,448	1,149	6,450	1,230	3,480	937	2,097	104
All States	1982	197,525	26,472	55,528	19,582	40,977	18,098	32,493	4,374
	1989	195,916	25,939	59,663	16,639	36,068	18,863	35,235	3,510
	1999	200,736	24,337	64,693	18,470	32,532	0,866	38,316	1,522

Numbers in columns may not sum to totals due to rounding.

a Except for Kentucky, data for 1982, 1989, and 1999 are based on FIA surveys conducted between 1972-1982,

1982-1989, and 1990-1999, respectively. Kentucky data for 1999 are from the 1988 FIA survey, data for both the 1982 and 1989 reporting years are from the 1975 FIA survey of Kentucky.

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Table 8--Area of timberland by State, forest management type, and year, Southern United States[a]

State and forest management type	Year					
	1952[b]	1962[b]	1970[b]	1982[c]	1989[c]	1999[c]
	Thousand acres					
Alabama						
Planted pine	165	814	1,203	1,293	1,903	3,432
Natural pine	6,672	8,327	6,955	6,719	5,326	4,015
Oak-pine	5,803	4,839	4,982	5,081	4,426	4,522
Upland hardwoods	5,622	5,397	5,773	5,650	7,415	7,650
Lowland hardwoods	2,495	2,366	2,505	2,502	2,495	2,270
All types	20,757	21,743	21,418	21,244	21,564	21,889
Arkansas						
Planted pine	55	161	256	436	1,193	1,839
Natural pine	4,481	4,690	4,180	3,867	2,999	3,238
Oak-pine	2,181	2,667	2,870	2,995	3,039	3,137
Upland hardwoods	8,500	8,351	7,779	6,568	7,269	7,127
Lowland hardwoods	4,410	4,102	2,947	2,825	2,733	3,018
All types	19,627	19,971	18,032	16,692	17,233	18,359
Florida						
Planted pine	291	1,506	2,645	3,267	3,987	4,627
Natural pine	10,311	6,911	5,365	3,920	3,085	2,547
Oak-pine	751	1,137	1,558	1,320	1,116	1,463

Upland hardwoods	2,452	2,565	2,423	1,240	1,114	1,981
Lowland hardwoods	4,330	4,711	4,270	3,907	3,910	3,604
All types	18,135	16,830	16,261	13,654	13,212	14,222
			Georgia			
Planted pine	357	1,592	2,738	3,583	5,031	6,070
Natural pine	13,260	11,620	9,855	7,650	5,886	4,570
Oak-pine	2,266	3,604	3,674	2,921	3,048	3,567
Upland hardwoods	3,619	4,971	5,230	5,448	5,582	5,422
Lowland hardwoods	4,467	4,511	3,605	3,438	3,422	3,777
All types	23,969	26,298	25,102	23,040	22,969	23,406
			Louisiana			
Planted pine	103	893	1,274	1,406	1,471	2,16
Natural pine	4,625	4,575	4,022	3,651	3,505	2,837
Oak-pine	2,644	2,242	2,199	2,169	1,897	1,887
Upland hardwoods	2,046	1,800	1,734	1,680	2,165	2,079
Lowland hardwoods	6,621	6,526	5,901	5,292	4,747	4,741
All types	16,039	16,036	15,130	14,198	13,785	13,713
			Mississippi			
Planted pine	284	645	933	1,138	1,544	2,96
Natural pine	5,147	5,133	5,166	4,106	3,248	2,788
Oak-pine	4,309	3,305	3,162	3,434	3,470	3,218
Upland hardwoods	3,541	4,319	3,992	4,310	5,508	5,834
Lowland hardwoods	3,572	3,642	3,522	3,522	3,174	3,711
All types	16,853	17,044	16,775	16,510	16,944	18,515

North Carolina						
Planted pine	96	359	762	1,004	1,614	2,093
Natural pine	8,607	7,962	7,084	5,724	4,626	4,103
Oak-pine	2,027	2,405	2,468	2,484	2,252	2,568
Upland hardwoods	5,653	6,248	7,010	7,249	7,001	7,169
Lowland hardwoods	3,199	3,015	2,806	2,595	2,629	2,624
All types	19,582	19,989	20,130	19,056	18,122	18,557
Oklahoma						
Planted pine	6	33	50	49	250	474
Natural pine	728	732	751	766	706	624
Oak-pine	607	637	672	704	747	702
Upland hardwoods	3,406	3,063	2,696	2,369	2,600	2,591
Lowland hardwoods	328	427	451	424	439	504
All types	5,075	4,892	4,620	4,312	4,742	4,895
South Carolina						
Planted pine	233	759	1,077	1,354	2,004	2,672
Natural pine	5,888	4,781	4,430	4,168	3,388	2,847
Oak-pine	834	1,454	1,794	1,716	1,533	1,893
Upland hardwoods	1,769	2,456	2,879	2,760	2,482	2,483
Lowland hardwoods	3,160	2,721	2,265	2,233	2,498	2,468
All types	11,884	12,171	12,445	12,231	11,905	12,363
Tennessee						
Planted pine	106	297	317	317	357	458
Natural pine	1,693	1,164	1,019	1,035	1,041	1,011

Oak-pine	2,191	1,328	1,595	1,422	1,592	1,625
Upland hardwoods	7,610	9,536	9,192	9,396	9,588	9,927
Lowland hardwoods	951	1,040	698	790	682	850
All types	12,551	13,365	12,821	12,959	13,260	13,871
			Texas			
Planted pine	104	293	457	558	1,191	1,767
Natural pine	5,643	5,165	4,583	4,047	3,064	2,530
Oak-pine	2,178	2,314	2,458	2,591	2,365	2,502
Upland hardwoods	2,886	2,855	2,954	2,672	3,362	3,127
Lowland hardwoods	2,270	2,333	2,267	1,782	1,566	1,806
All types	13,081	12,960	12,719	11,650	11,548	11,732
			Virginia			
Planted pine	46	235	432	680	1,170	1,468
Natural pine	4,932	3,848	3,282	2,722	2,158	1,848
Oak-pine	1,297	1,569	1,753	1,921	1,682	1,932
Upland hardwoods	8,278	9,541	9,897	9,724	9,642	9,473
Lowland hardwoods	944	559	495	673	586	622
All types	15,497	15,752	15,859	15,720	15,238	15,343
All States						
Planted pine	1,846	7,587	12,144	15,085	21,715	30,033
Natural pine	71,987	64,908	56,692	48,375	39,032	32,958
Oak-pine	27,088	27,501	29,185	28,757	27,167	29,016
Upland hardwoods	55,382	61,102	61,559	59,066	63,728	64,863

Lowland hardwoods	36,747	35,953	31,732	29,983	28,881	29,995
All types[d]	193,050	197,051	191,312	181.265	180,522	186,865

Numbers in columns may not sum to totals due to rounding.

a Excludes Kentucky.

b Data for 1952, 1962, and 1970 are from The South's Fourth Forest (USDA Forest Service 1988).

c Data for 1982, 1989, and 1999 are based on FIA surveys conducted between 1972-1982, 1982-1989, and 1990-1999, respectively.

d Does not include Nonstocked acres.

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Table 9--Change in area of timberland between 1989 and 1999 by State, previous and current forest management type, Southern United States[a]

State and previous forest management type	Current forest management type[b]						
	Planted pine-oak pine	Natural pine	Natural oak-pine	Upland hardwood	Lowland hardwood	Non-stocked	Non- forest
	Thousand acres						
Alabama							
Planted pine/oak-pine	1,977	137	51	160	—	5	33
Natural pine	473	2,832	1,023	801	45	11	146
Natural oak-pine	265	604	1,592	1,157	28	—	116
Upland hardwood	621	207	1,011	5,116	115	6	196
Lowland hardwood	47	6	104	172	2,026	—	68
Nonstocked	12	5	—	—	6	5	—
Nonforest	644	224	134	245	50	16	—
All types	4,039	4,015	3,915	7,649	2,270	44	—
Arkansas							
Planted pine/oak-pine	1,393	131	31	52	6	—	6
Natural pine	182	2,268	377	234	6	—	92
Natural oak-pine	86	628	1,595	422	6	—	62
Upland hardwood	350	109	556	5,979	179	7	309
Lowland hardwood	19	—	36	41	2,620	14	71
Nonstocked	6	—	—	—	—	—	—
Nonforest	174	102	173	400	201	12	—

All types	2,210	3,238	2,767	7,127	3,018	32	—
Florida							
Planted pine/oak-pine	3,714	132	38	147	32	—	54
Natural pine	433	2,349	293	136	67	—	172
Natural oak-pine	61	199	522	117	104	—	63
Upland hardwood	252	10	174	1,474	12	—	149
Lowland hardwood	136	34	171	87	3,481	—	135
Nonstocked	—	—	—	—	—	—	—
Nonforest	299	80	20	53	25	—	—
All types	4,895	2,804	1,218	2,013	3,720	—	—
Georgia							
Planted pine/oak-pine	4,669	165	72	125	59	—	61
Natural pine	617	3,785	811	471	158	—	330
Natural oak-pine	114	404	1,405	436	159	—	106
Upland hardwood	503	97	582	4,343	108	—	267
Lowland hardwood	129	30	236	65	3,354	—	72
Nonstocked	—	—	—	—	—	—	—
Nonforest	528	219	54	63	37	—	—
All types	6,560	4,700	3,159	5,503	3,875	—	—
Louisiana							
Planted pine/oak-pine	1,446	88	29	82	—	11	19
Natural pine	362	2,104	487	402	6	16	90

Natural oak-pine	154	434	605	335	85	5	22
Upland hardwood	363	135	363	857	353	—	78
Lowland hardwood	28	—	67	310	3,985	5	143
Nonstocked	5	—	—	—	6	11	7
Nonforest	119	76	27	93	306	22	—
All types	2,478	2,838	1,578	2,079	4,741	70	—
Mississippi							
Planted pine/oak-pine	1,897	104	69	186	5	13	37
Natural pine	299	1,902	455	504	22	—	82
Natural oak-pine	114	420	1,261	766	106	—	48
Upland hardwood	604	123	546	3,888	277	6	136
Lowland hardwood	18	—	70	92	3,031	13	36
Nonstocked	7	—	—	—	—	—	—
Nonforest	705	240	136	398	270	42	—
All types	3,645	2,788	2,537	5,834	3,711	73	—
North Carolina							
Planted pine/oak-pine	1,600	17	9	29	2	—	20
Natural pine	252	3,583	513	218	96	—	170
Natural oak-pine	48	383	1,346	320	96	—	45
Upland hardwood	170	69	421	6,327	145	—	177
Lowland hardwood	99	10	86	258	2,312	—	59
Nonstocked	—	—	—	—	—	—	—
Nonforest	87	101	48	49	15	—	—

All types	2,257	4,163	2,422	7,202	2,666	—	—
Oklahoma							
Planted pine/oak-pine	423	6	—	6	—	—	—
Natural pine	39	512	105	36	—	—	11
Natural oak-pine	—	94	386	66	—	—	6
Upland hardwood	103	6	102	2,218	34	—	50
Lowland hardwood	6	—	—	33	396	—	—
Nonstocked	—	—	—	—	—	—	—
Nonforest	—	6	12	232	74	—	—
All types	571	624	605	2,591	504	—	—
South Carolina							
Planted pine/oak-pine	1,913	80	54	60	21	—	24
Natural pine	245	2,367	444	181	103	—	93
Natural oak-pine	76	269	770	200	99	—	36
Upland hardwood	176	24	304	1,960	95	—	118
Lowland hardwood	117	23	143	71	2,151	—	48
Nonstocked	—	—	—	—	—	—	—
Nonforest	286	126	47	30	21	—	—
All types	2,812	2,890	1,762	2,502	2,489	—	—
Tennessee							
Planted pine/oak-pine	391	5	14	20	—	2	3
Natural pine	30	886	83	62	5	5	51

Natural oak-pine	26	28	1,250	166	3	3	81
Upland hardwood	57	9	71	9,193	28	39	360
Lowland hardwood	6	—	4	39	691	8	31
Nonstocked	—	—	—	—	—	6	—
Nonforest	43	82	110	448	123	32	—
All types	552	1,011	1,531	9,927	850	94	—
Texas							
Planted pine/oak-pine	1,254	87	42	81	6	7	33
Natural pine	288	1,936	421	257	17	—	75
Natural oak-pine	169	299	1,000	424	42	—	39
Upland hardwood	405	98	408	1,940	237	6	202
Lowland hardwood	22	6	52	40	1,341	—	171
Nonstocked	—	—	—	—	—	—	—
Nonforest	118	106	92	386	163	29	—
All types	2,254	2,530	2,015	3,127	1,806	42	—
Virginia							
Planted pine/oak-pine	1,275	18	—	55	—	—	11
Natural pine	115	1,617	227	134	4	—	83
Natural oak-pine	41	171	923	302	5	—	38
Upland hardwood	277	20	459	8,881	88	—	170
Lowland hardwood	8	3	3	73	524	—	31
Nonstocked	—	—	—	—	—	—	—
Nonforest	43	51	43	74	14	—	—

All types	1,758	1,880	1,656	9,518	635	—	—
All states[a]							
Planted pine/oak-pine	21,951	970	408	1,001	131	37	300
Natural pine	3,335	26,140	5,238	3,437	528	32	1,394
Natural oak-pine	1,154	3,933	12,653	4,710	732	8	660
Upland hardwood	3,881	908	4,997	52,176	1,671	63	2,210
Lowland hardwood	634	112	973	1,281	25,913	40	864
Nonstocked	30	5	—	—	11	22	7
Nonforest	3,046	1,412	895	2,470	1,299	153	—
All types	34,031	33,479	25,163	65,074	30,285	355	—

Numbers in columns may not sum to totals due to rounding.

a Excludes Kentucky.

b Data are based on FIA surveys conducted between 1990 and 1999.

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Table 10--Area of timberland by stand-age class and forest management type, Southern United States[a], 1999

Stand-age class	Forest management type[b]							
	All types	Pine planted	Oak-pine planted	Natural pine	Natural oak-pine	Upland hardwood	Lowland hardwood	Non-stocked
	Thousand acres							
0–7	25,715	8,495	1,607	3,019	2,624	7,327	2,384	259
8–12	16,137	6,500	829	2,199	1,801	3,529	1,228	51
13–17	14,911	5,492	559	2,583	1,908	3,369	992	8
18–22	13,987	3,813	266	3,257	2,172	3,441	1,023	15
23–27	12,842	2,413	253	3,419	2,273	3,366	1,111	6
28–32	12,270	1,476	189	3,356	2,323	3,672	1,252	3
33–37	12,605	1,034	120	3,297	2,236	4,137	1,781	0
38–42	12,655	506	72	3,056	2,053	4,791	2,177	0
43–47	11,483	132	25	2,465	1,821	4,740	2,300	—
48–52	10,876	101	13	1,857	1,533	4,926	2,444	2
53–57	9,753	80	7	1,616	1,198	4,253	2,598	—
58–62	8,823	17	—	1,059	889	4,292	2,564	2
63–67	6,966	24	—	762	706	3,255	2,217	3
68–72	5,198	—	—	599	388	2,733	1,476	2
73–77	4,097	3	—	358	419	2,001	1,315	2
78–82	2,836	—	—	218	246	1,425	944	2
83–87	2,259	—	6	124	205	1,137	788	—
88–92	1,833	—	—	91	146	882	713	—

93–97+	3,144	—	—	143	224	1,798	980	—
All classes	18,388	30,086	3,945	33,479	25,164	65,075	30,285	355

a Excludes Kentucky

b Data are based on FIA surveys conducted between 1990 and 1999.

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Table 11--Volume of growing stock on timberland by State and year, Southern United States

State	1953	1963	1982	1989	1999
	Million cubic feet				
Alabama	12,352	16,466	20,958	21,812	23,075
Arkansas	14,109	15,069	17,021	19,241	21,686
Florida	8,901	10,686	13,450	14,970	15,366
Georgia	19,351	22,701	29,418	30,787	31,704
Kentucky	6,351	8,924	11,968	14,610	15,952
Louisiana	11,009	14,668	17,155	18,992	18,844
Mississippi	10,044	11,541	17,235	19,815	20,611
North Carolina	21,420	23,160	29,231	32,064	32,742
Oklahoma	1,381	1,519	2,062	2,219	3,624
South Carolina	10,212	12,268	16,797	17,733	16,685
Tennessee	8,250	9,298	12,001	14,292	16,646
Texas	7,893	9,415	13,274	12,887	12,939
Virginia	17,197	18,357	22,803	120,773	26,487
Total	148,470	174,072	223,373	244,641	256,361

Data Source: 1997 RPA (includes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 12--Volume of softwood growing stock on timberland by State and year, Southern Unites States

State	1953	1963	1982	1989	1999
			Million cubic feet		
Alabama	5,875	8,684	11,469	11,328	11,101
Arkansas	4,640	5,812	7,973	8,586	9,342
Florida	5,384	6,685	8,750	9,305	9,424
Georgia	10,751	12,513	16,096	15,870	15,224
Kentucky	493	567	916	1,110	1,213
Louisiana	4,253	6,357	9,342	10,552	9,928
Mississippi	3,674	5,259	8,930	9,746	9,208
NorthCarolina	9,097	9,634	11,526	12,286	12,530
Oklahoma	541	692	1,011	998	1,421
SouthCarolina	4,800	6,066	8,708	8,835	8,034
Tennessee	1,227	1,480	2,203	2,710	2,893
Texas	4,211	6,062	8,356	7,964	7,879
Virginia	5,516	5,276	5,928	6,323	6,648
Total	60,462	75,087	101,208	105,613	104,846

Data Source: 1997 RPA (includes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 13--Volume of hardwood growing stock on timberland by state and year, Southern Unites States

State	1953	1963	1982	1989	1999
			Million cubic feet		
Alabama	6,477	7,782	9,489	10,484	11,974
Arkansas	9,469	9,257	9,048	10,655	12,344
Florida	3,517	4,001	4,700	5,665	5,942
Georgia	8,600	10,188	13,322	14,917	16,480
Kentucky	5,858	8,357	11,052	13,500	14,739
Louisiana	6,756	8,311	7,813	8,440	8,916
Mississippi	6,370	6,282	8,305	10,069	11,402
NorthCarolina	12,323	13,526	17,705	19,778	20,212
Oklahoma	840	827	1,051	1,221	2,203
SouthCarolina	5,412	6,202	8,089	8,898	8,651
Tennessee	7,023	7,818	9,798	11,582	13,753
Texas	3,682	3,353	4,918	4,923	5,060
Virginia	11,681	13,081	16,875	68,154	19,838
Total	88,008	98,985	122,165	139,028	151,515

Data Source: 1997 RPA (includes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 14--Volume of growing stock on timberland by year and diameter class, Southern Unites States

		Diameter class (*inches at breast height*)									
Year	All classes	5.0-6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29+
		Million cubic feet									
1953	148,470	15,230	21,998	25,726	24,255	19,942	14,316	9,955	6,271	9,221	1,556
1963	174,072	19,733	26,809	30,026	28,160	23,055	16,602	11,232	7,119	9,767	1,568
1982	223,373	25,538	34,090	37,586	35,077	29,755	22,367	14,902	9,257	12,648	2,151
1989	244,641	24,596	35,011	39,759	38,663	33,352	25,642	17,853	11,303	15,765	2,695
1999	256,361	23,595	34,572	38,540	37,796	34,645	28,155	20,439	14,054	20,664	3,901

Data Source: 1997 RPA (includes Kentucky data).

Numbers in rows may not sum to totals due to rounding.

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Table 15--Volume of softwood growing stock on timberland by year and diameter class, Southern Unites States

Year	All classes	Diameter class (*inches at breast height*) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29+
		Million cubic feet									
1953	60,462	7,143	10,610	12,027	10,912	7,738	5,106	3,109	1,691	1,879	247
1963	75,087	9,339	13,074	14,241	13,050	9,653	6,625	4,108	2,354	2,399	243
1982	101,208	12,107	17,075	18,551	16,986	13,390	9,463	5,906	3,490	3,827	413
1989	105,613	11,248	16,941	18,863	17,825	14,349	10,332	6,771	4,058	4,689	540
1999	104,846	11,393	16,888	17,160	16,407	14,049	10,849	7,204	4,564	5,637	694

Data Source: 1997 RPA (includes Kentucky data).

Numbers in rows may not sum to totals due to rounding.

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Table 16--Volume of hardwood growing stock on timberland by year and diameter class, Southern United States

Year	All classes	Diameter class (*inches at breast height*) 5.0–6.9	7.0–8.9	9.0–10.9	11.0–12.9	13.0–14.9	15.0–16.9	17.0–18.9	19.0–20.9	21.0–28.9	29+
		Million cubic feet									
1953	88,008	8,087	11,388	13,699	13,343	12,204	9,210	6,846	4,580	7,342	1,309
1963	98,985	10,394	13,735	15,785	15,110	13,402	9,977	7,124	4,765	7,368	1,325
1982	122,165	13,431	17,015	19,035	18,091	16,365	12,904	8,996	5,767	8,821	1,738
1989	139,028	13,348	18,070	20,896	20,838	19,003	15,310	11,082	7,245	11,076	2,155
1999	151,516	12,202	17,684	21,380	21,389	20,596	17,306	13,235	9,490	15,026	3,207

Data Source: 1997 RPA (includes Kentucky data).

Numbers in rows may not sum to totals due to rounding.

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Table 17--Volume of growing stock on timberland by year and ownership class, Southern United States

Year	All classes	Ownership class			
		National forest	Other public	Forest industry	Nonindustrial private
	Million cubic feet				
1953	148,470	9,766	4,574	27,785	106,345
1963	174,072	13,245	5,818	34,869	120,140
1982	223,373	16,871	8,503	40,775	157,224
1989	244,641	19,319	11,410	41,983	171,928
1999	256,361	20,409	15,421	40,807	179,725

Data Source: 1997 RPA (includes Kentucky data).

Numbers in rows may not sum to totals due to rounding.

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Table 18--Volume of growing stock on timberland by forest-type group and year, Southern United States

Forest-type group	Year	
	1989	1999
	Million cubic feet	
White-red-jack pine	1,265	1,778
Spruce-fir	23	16
Planted longleaf-slash	5,643	6,283
Natural longleaf-slash	9,731	7,464
Planted loblolly-shortleaf	9,025	18,009
Natural loblolly-shortleaf	53,357	47,045
Oak-pine	29,900	32,849
Oak-hickory	70,445	82,063
Oak-gum-cypress	43,202	46,519
Elm-ash-cottonwood	3,591	2,734
Maple-beech-birch	672	833
Nontyped	2	5
All groups	226,855	245,597

Data Source: FIA database (excludes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 19--Average net annual growth of growing stock on timberland by species group and year, Southern Unites States

Species group	Year				
	1953	1963	1982	1989	1999
	Million cubic feet				
Softwoods	3,641	4,699	6,315	5,499	5,889
Hardwoods	3,041	3,394	5,009	4,487	4,823
All species	6,683	8,093	11,323	9,986	10,712

Data Source: 1997 RPA (includes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 20--Average net annual growth of growing stock on timberland by year and ownership class, Southern United States

Year	Ownership class				
	All classes	National forest	Other public	Forest industry	Nonindustrial private
	Million cubic feet				
1953	6,683	432	209	1,456	4,586
1963	8,093	624	245	1,841	5,383
1982	11,323	667	400	2,294	7,962
1989	9,985	598	389	2,147	6,851
1999	10,712	498	439	2,574	7,201

Data Source: 1997 RPA (includes Kentucky data).

Numbers in rows may not sum to totals due to rounding.

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Table 21--Average annual growth of growing stock on timberland by forest-type group and year, Southern United States

Forest-type group	Year	
	1989	1999
	Million cubic feet	
White-red-jack pine	42	47
Planted longleaf-slash	568	596
Natural longleaf-slash	363	294
Planted loblolly-shortleaf	821	1,863
Natural loblolly-shortleaf	2,340	2,023
Oak-pine	1,287	1,419
Oak-hickory	2,635	2,873
Oak-gum-cypress	1,203	1,258
Elm-ash-cottonwood	109	72
Maple-beech-birch	19	15
Nontyped	3	19
All groups	9,391	10,478

Data Source: FIA database (excludes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 22--Average annual removals of growing stock on timberland by species group and year, Southern United States

Species group	Year		
	1982	1989	1999
	Million cubic feet		
Softwoods	4,436	5,317	6,478
Hardwoods	2,242	2,887	3,707
All species	6,679	8,204	10,185

Data Source: 1997 RPA (includes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 23--Average annual removals of growing stock on timberland by year and ownership class, Southern United States

Year	All classes	Ownership class			
		National forest	Other public	Forest industry	Nonindustrial private
	Million cubic feet				
1982	6,935	258	247	1,980	4,450
1989	6,880	336	87	2,246	4,212
1999	8,335	136	382	2,436	5,382

Data Source: 1997 RPA (includes Kentucky data).

Numbers in rows may not sum to totals due to rounding.

Return to first reference in text

Table 24--Average annual removals of growing stock on timberland by forest-type group and year, Southern United States

Forest-type group	Year	
	1989	1999
	Million cubic feet	
White-red-jack pine	9	22
Planted longleaf-slash	394	376
Natural longleaf-slash	204	200
Planted loblolly-shortleaf	974	1,293
Natural loblolly-shortleaf	950	1,170
Oak-pine	1,160	1,598
Oak-hickory	2,434	3,194
Oak-gum-cypress	850	1,104
Elm-ash-cottonwood	67	65
Maple-beech-birch	5	10
Nontyped	223	305
All groups	7,270	9,336

Data Source: FIA database (excludes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

Return to first reference in text

Table 25--Average annual mortality of growing stock on timberland by species group and year, Southern United States

Species group	Year				
	1953	1963	1982	1989	1999
	Million cubic feet				
Softwoods	333	399	632	841	1,036
Hardwoods	639	770	646	832	1,200
All species	972	1,169	1,278	1,673	2,236

Data Source: 1997 RPA (includes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

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Table 26--Average annual mortality of growing stock on timberland by year and ownership class, Southern United States

Year	All classes	Ownership class			
		National forest	Other public	Forest industry	Nonindustrial private
		Million cubic feet			
1953	972	55	29	178	711
1963	1,169	68	41	227	833
1982	1,278	80	57	231	911
1989	1,673	113	83	286	1,192
1999	2,236	175	141	351	1,570

Data Source: 1997 RPA (includes Kentucky data).

Numbers in rows may not sum to totals due to rounding.

Return to first reference in text

Table 27--Average annual mortality of growing stock on timberland by forest-type group and year, Southern United States

Forest-type group	Year	
	1989	1999
	Million cubic feet	
White-red-jack pine	6	13
Planted longleaf-slash	0	0
Natural longleaf-slash	36	36
Planted loblolly-shortleaf	48	47
Natural loblolly-shortleaf	59	113
Oak-pine	351	399
Oak-hickory	254	345
Oak-gum-cypress	568	658
Elm-ash-cottonwood	391	503
Maple-beech-birch	38	40
Nontyped	4	7
All groups	1,758	2 ,162

Data Source: FIA database (excludes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

Return to first reference in text

Table 28--Volume, average net annual growth, average annual removals, and mortality of growing stock on timberland by species and stand origin, Southern United States, 1999

	Natural				Plantation			
Species	Volume	Growth	Removals	Mortality	Volume	Growth	Removals	Mortality
	Million cubic feet							
Softwoods								
Longleaf-slashpine	9,698	436	571	79	6,233	640	571	39
Loblolly-shortleafpine	51,583	2,461	3,065	605	17,335	1,852	1,182	108
Otherpine	8,609	259	276	155	389	40	77	2
Easternwhite-redpine	1,884	60	36	13	239	11	4	1
Spruce-fir	24	1	0	1	0	0	0	0
Easternhemlock	628	19	6	2	2	0	0	0
Cypress	6,410	112	74	19	12	0	4	0
Othersoftwood	1,231	50	14	14	24	2	2	0
TotalSoftwoods	80,066	3,397	4,042	887	24,234	2,545	1,841	152
Hardwoods								
Selectwhiteoak	14,750	474	287	57	246	15	54	3
Selectredoak	6,993	245	140	51	68	6	17	1
Otherwhiteoak	12,361	322	176	66	112	7	32	2
Otherredoak	26,254	956	667	308	591	48	147	7
Hickory	9,744	244	144	79	104	4	27	1
Yellowbirch	95	1	0	1	0	0	0	0

Hardmaple	1,218	42	12	4	2	0	0	0
Softmaple	7,371	264	114	59	102	7	21	1
Beech	1,843	45	29	7	22	1	2	0
Sweetgum	16,142	544	431	128	541	44	88	4
Tupelo-blackgum	11,096	226	160	58	91	5	24	0
Ashes	4,048	110	59	44	20	2	5	0
Cottonwoods-aspen	578	9	18	12	18	3	6	0
Basswood	513	11	5	2	3	0	0	0
Yellow-poplar	13,361	485	274	58	252	20	35	0
Blackwalnut	399	9	6	2	2	0	0	0
Othersofthardwood	9,845	311	158	128	178	16	20	0
Otherhardhardwood	2,109	42	29	40	26	2	4	0
Noncommercial	199	9	0	0	2	0	0	0
TotalHardwoods	138,918	4,347	2,708	1,102	2,379	179	482	20
All species	218,984	7,744	6,749	1,989	26,613	2,724	2,322	173

Data source: FIA database (excludes Kentucky data).

Numbers in columns may not sum to totals due to rounding.

Return to first reference in text

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Table 29--Area of timberland by Province and forest-type group, Southern United States, 1999

Province code	Province[a]	All groups	Forest-type group[b]									
			White-red jack- pine	Spruce-fir	Longleaf-slash pine	Loblolly-shortleaf pine	Oak - pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cotton-wood	Maple-beech-birch	Non typed
		Thousand acres										
221	Eastern Broadleaf Ocean	11,025	120	—	—	1,171	1,081	8,321	38	84	198	13
222	Eastern Broadleaf Continental	18,285	8	—	—	1,149	1,745	13,469	829	542	483	60
231	Southeast Mixed	79,538	21	—	993	27,852	14,798	26,811	8,251	715	1	97
232	Outer Coast Mixed	58,869	—	—	12,500	15,001	8,227	8,882	13,885	252	—	121
234	Lower MS Riverine	7,928	—	—	21	1,016	480	1,368	4,370	642	—	31
251	Prairie Park Temperate	279	—	—	—	7	—	253	19	—	—	—
255	Prairie Park Subtropical	3,332	—	—	—	490	371	1,668	685	90	—	29
411	Everglades	191	—	—	28	—	8	10	144	—	—	—

M221	Central Appalachian	14,466	543	13	—	1,279	1,857	10,310	13	74	374	4
M222	Ozark Broadleaf	2,621	—	—	—	304	441	1,820	44	12	—	—
M231	Ouachita Mixed	4,203	—	—	—	1,732	967	1,291	202	11	—	—
Total all Provinces		200,736	692	13	13,542	50,001	29,974	74,202	28,481	2,420	1,057	355

Numbers in rows and columns may not sum to totals due to rounding

a McNab and Avery 1994.

b Data are based on FIA surveys conducted between 1990 and 1999. Estimates include nonstocked acres

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Table 30--Area of timberland by Province for planted pine/oak-pine, natural pine/oak-pine, and hardwoods, Southern United States, 1999

Province code	Province[a]	All types	Forest management type[b]		
			Planted pine/ Oak-pine	Natural pine/ Oak-pine	Hardwoods
		Thousand acres			
221	Eastern Broadleaf Ocean	11,025	291	2,081	8,653
222	EasternBroadleaf Continental	18,285	398	2,504	15,384
231	Southeast Mixed	79,538	14,631	29,033	35,875
232	Outer Coast Mixed	58,869	16,668	19,061	23,140
234	Lower MS Riverine	7,928	411	1,106	6,411
251	Prairie Park Temperate	279	—	7	272
255	Prairie Park Subtropical	3,332	101	760	2,471
411	Everglades	191	—	37	154
M221	Central Appalachian	14,466	332	3,359	10,774
M222	Ozark Broadleaf	2,621	121	623	1,877
M231	Ouachita Mixed	4,203	1,194	1,505	1,504
	Total all Provinces	200,736	34,147	60,075	106,514

Numbers in rows and columns may not sum to totals due to rounding

a McNab and Avery 1994.

b Data are based on FIA surveys conducted between 1990 and 1999.

Estimates include nonstocked and nontyped acres.

Return to first reference in text

Table 31--Area of timberland by Province and ownership class, Southern United States, 1999

Province code	Province[a]	Ownership class[b]						
		All types	National forest	Miscellaneous Federal	Other public	Forest industry[c]	Private individual	Corporate
		Thousand acres						
221	Eastern Broadleaf Ocean	11,025	926	124	358	778	7,672	1,168
222	Eastern Broadleaf Continental	18,285	312	679	437	761	15,068	1,029
231	Southeast Mixed	79,538	2,958	1,660	1,207	16,682	50,513	6,519
232	Outer Coast Mixed	58,869	2,439	1,579	2,225	17,698	28,027	6,902
234	Lower MS Riverine	7,928	251	308	513	1,490	3,996	1,370
251	Prairie Park Temperate	279	—	46	7	—	190	36
255	Prairie Park Subtropical	3,332	—	104	47	200	2,648	333
411	Everglades	191	—	—	9	—	162	20
M221	Central Appalachian	14,466	3,188	111	292	399	8,805	1,672
M222	Ozark Broadleaf	2,621	776	31	37	90	1,598	90
M231	Ouachita Mixed	4,203	709	83	59	1,930	1,254	169
	Total all Provinces	200,736	11,558	4,724	5,190	40,027	119,932	19,306

Numbers in rows and columns may not sum to totals due to rounding

a McNab and Avery 1994.

b Data are based on FIA surveys conducted between 1990 and 1999.

c includes timberland under long-term lease.

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Table 32--Volume of live timber on timberland by Province, softwood and hardwood, Southern United States, 1999

Province code	Province[a]	Volume[b]		
		All types	Softwood	Hardwood
		Million cubic feet		
221	Eastern Broadleaf Ocean	18,944	3,285	15,658
222	Eastern Broadleaf Continental	25,323	2,211	23,111
231	Southeast Mixed	108,170	48,944	59,226
232	Outer Coast Mixed	77,694	39,802	37,892
234	Lower MS Riverine	13,332	3,135	10,197
251	Prairie Park Temperate	253	9	244
255	Prairie Park Subtropical	2,788	830	1,958
411	Everglades	212	183	30
M221	Central Appalachian	30,142	5,423	24,720
M222	Ozark Broadleaf	3,299	677	2,622
M231	Ouachita Mixed	4,645	2,727	1,917
	Total all Provinces	284,801	107,225	177,575

Numbers in rows and columns may not sum to totals due to rounding

a McNab and Avery 1994.

b Data are based on FIA surveys conducted between 1990 and 1999.

Return to first reference in text

Table 33--Average net annual growth and removals of live trees[a] on timberland by Province, softwood and hardwood, Southern United States, 1999

Province code	Province	Net annual growth			Annual timber removals		
		Total	Softwood	Hardwood	Total	Softwood	Hardwood
		Million cubic feet					
221	Eastern Broadleaf Ocean	491	100	391	203	75	127
222	Eastern Broadleaf Continental	672	90	582	394	59	335
231	Southeast Mixed	4,866	2,906	1,960	4,675	3,063	1,613
232	Outer Coast Mixed	3,300	2,324	976	3,275	2,380	895
234	Lower MS Riverine	429	129	300	338	130	208
251	Prairie Park Temperate	12	0	12	2	—	2
255	Prairie Park Subtropical	124	57	67	66	46	19
411	Everglades	3	4	-1	5	4	1
M221	Central Appalachian	633	149	485	374	132	242
M222	Ozark Broadleaf	93	30	63	37	20	17
M231	Ouachita Mixed	239	182	57	147	109	38
Total all Provinces		10,862	5,970	4,892	9,516	6,019	3,496

Numbers in rows and columns may not sum to totals due to rounding

a Excludes trees less than 5.0 inches in diameter at breast height.

b McNab and Avery 1994.

c Data are based on FIA surveys conducted between 1990 and 1999.

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Figure 1--Forest area in the Southern United States, 1630-1999.

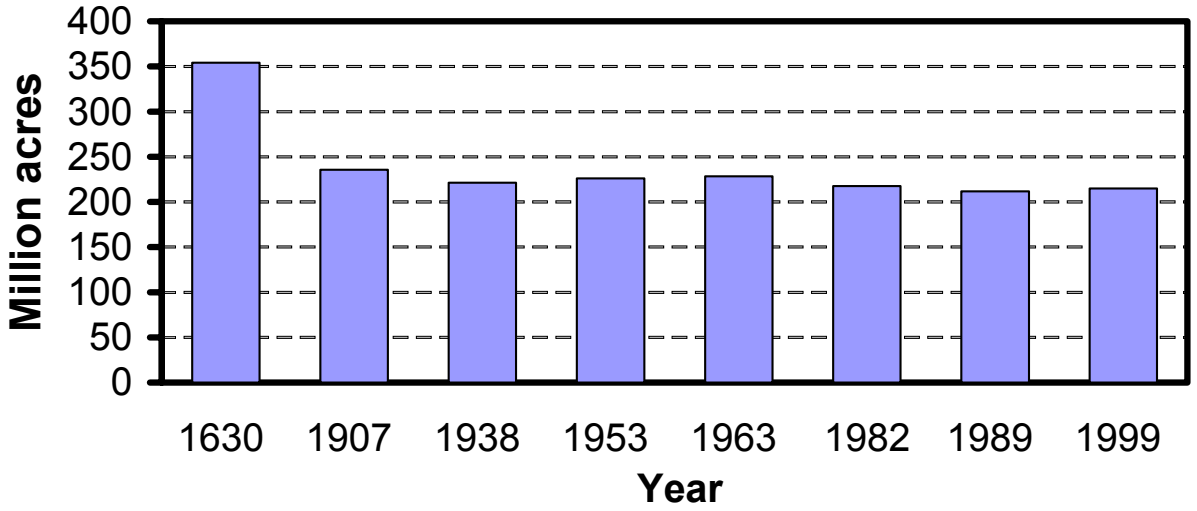

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Figure 2--Average annual diversion of forest land to agriculture and urban land uses, Southern United States, 1968-1990 (excludes Kentucky).

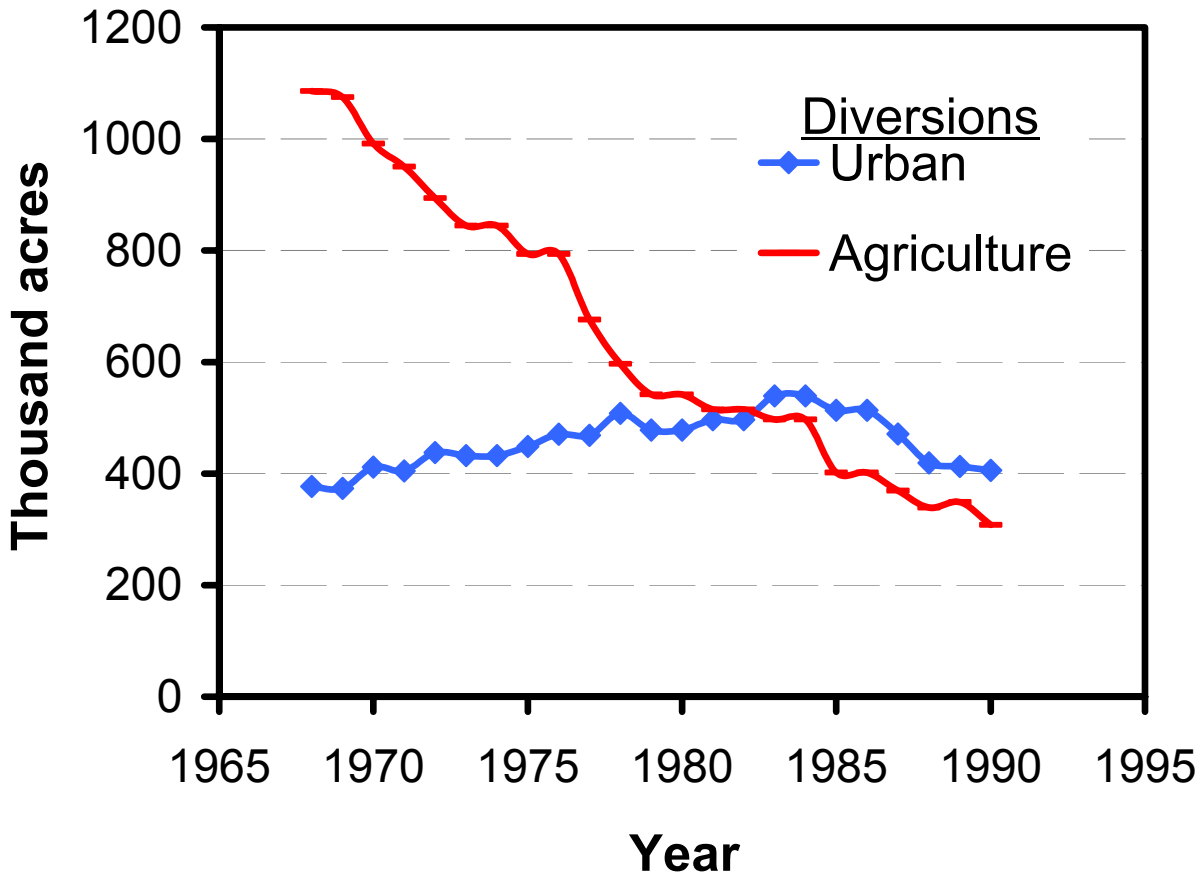

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Figure 3--Average annual change in area of forest land in the Southern United States, 1970-1990 (excludes Kentucky).

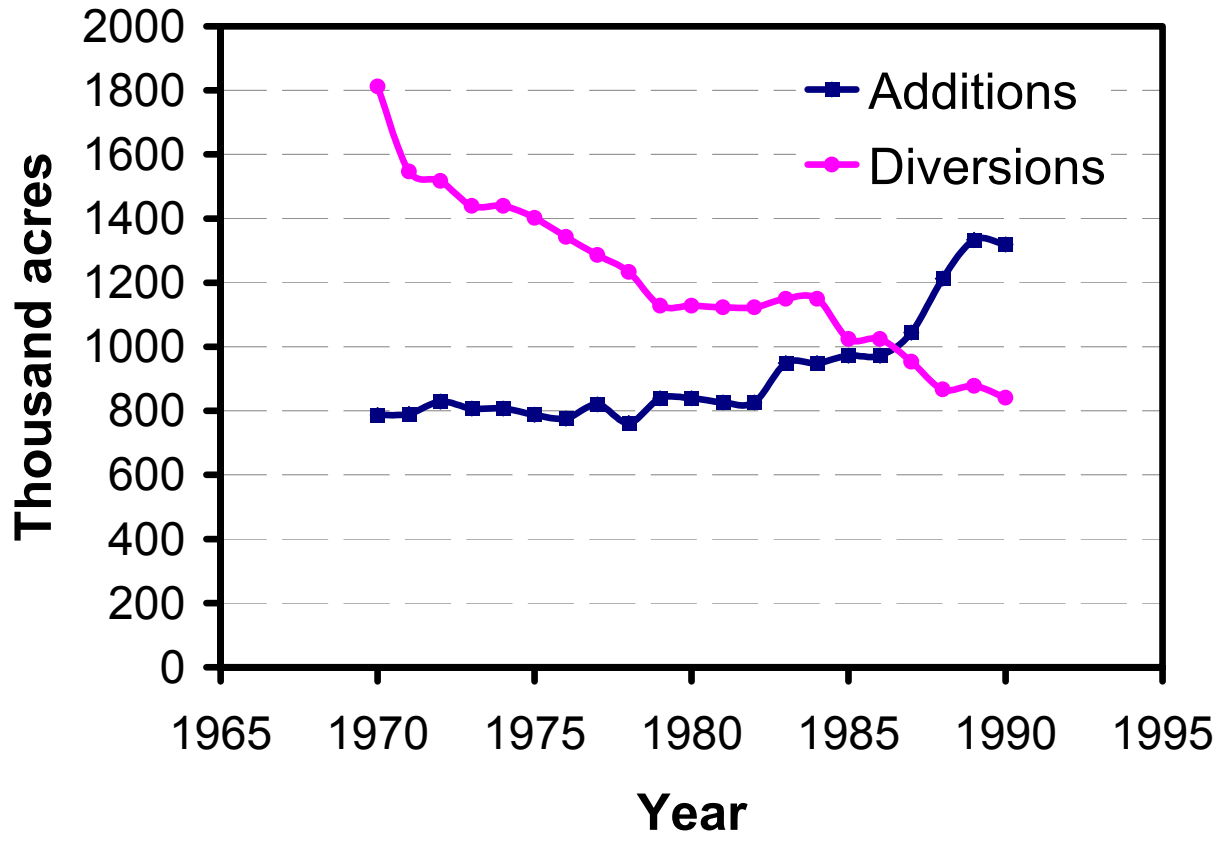

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Figure 4--Total timberland area, and reserved and other forest land by year, Southern United States.

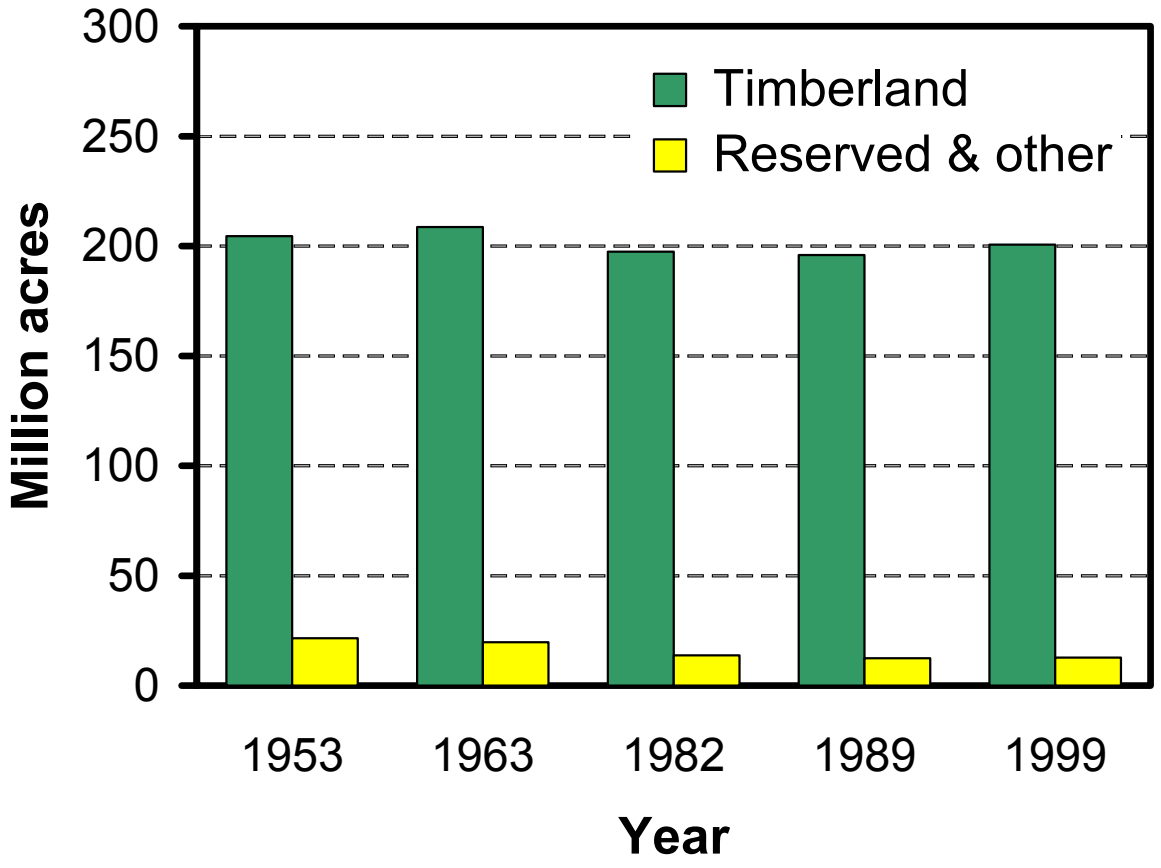

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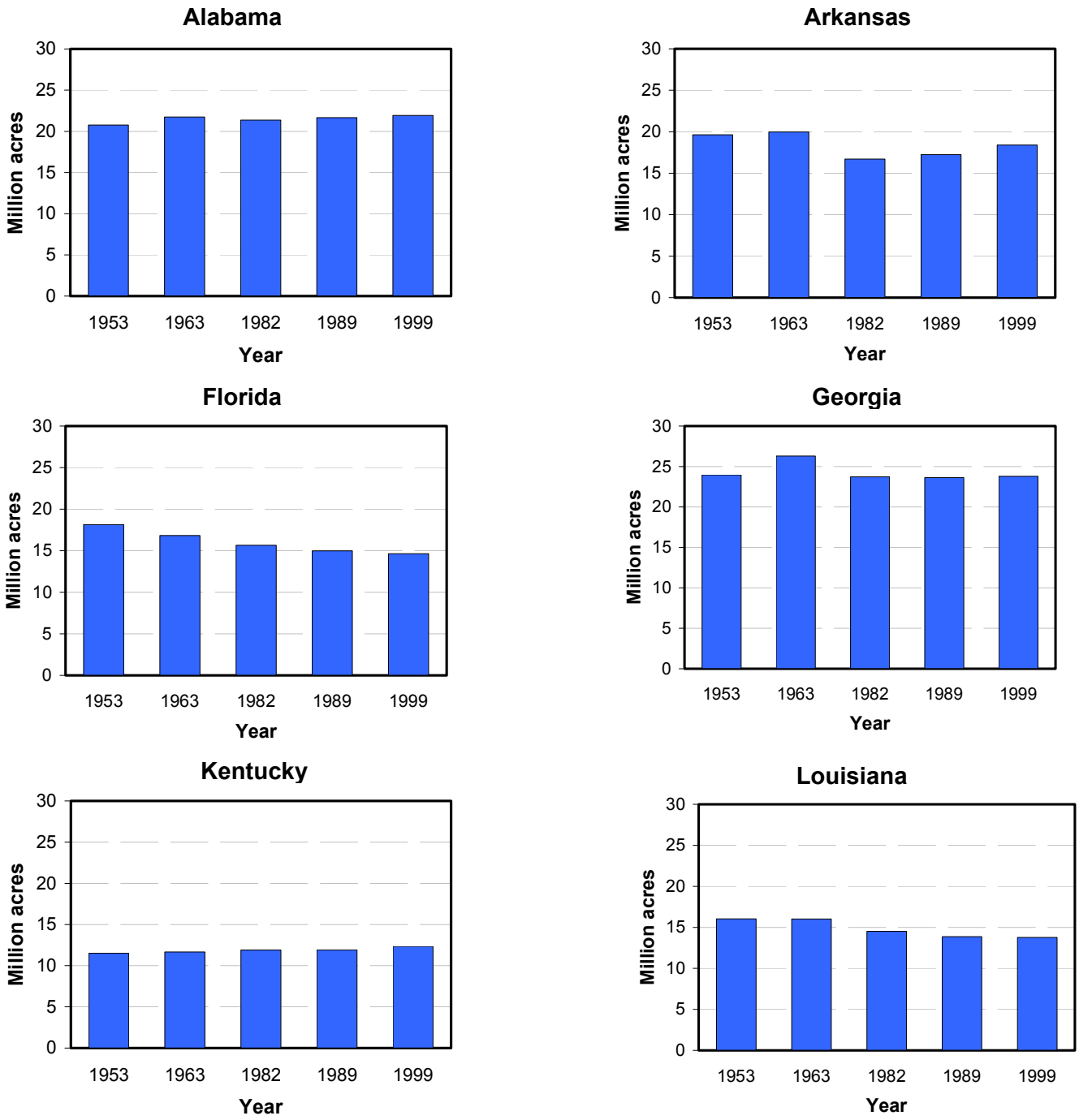
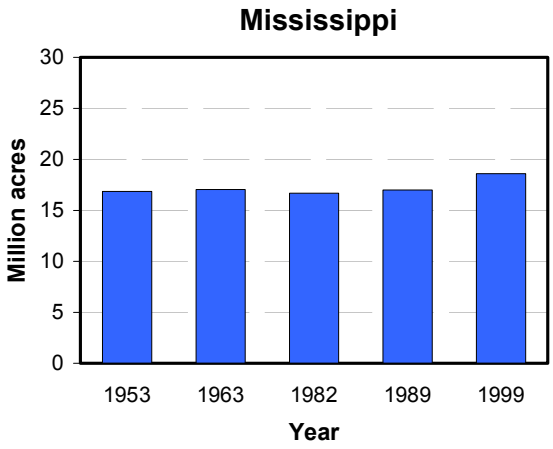
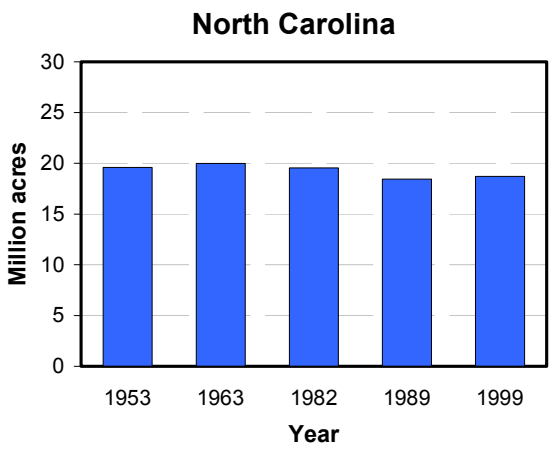
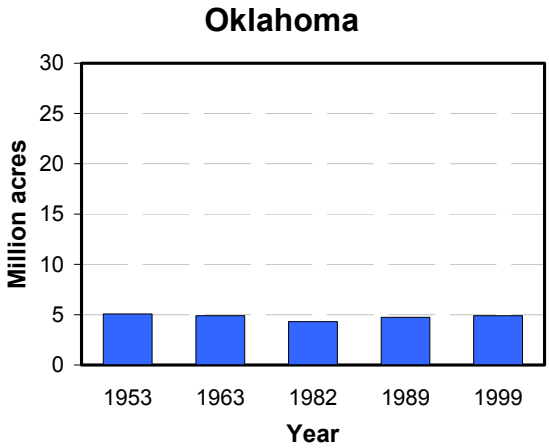
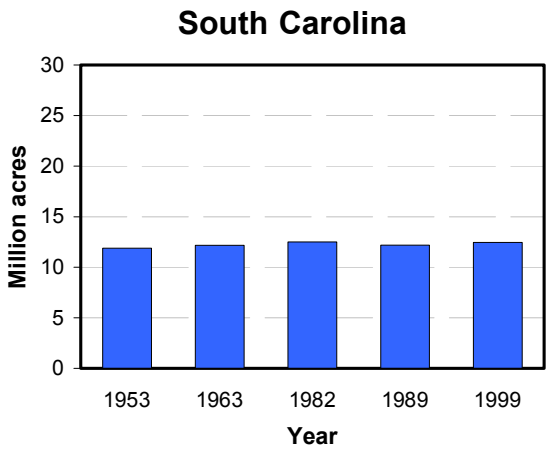
Figure 5--Trends in area of timberland by State and year, Southern United States.

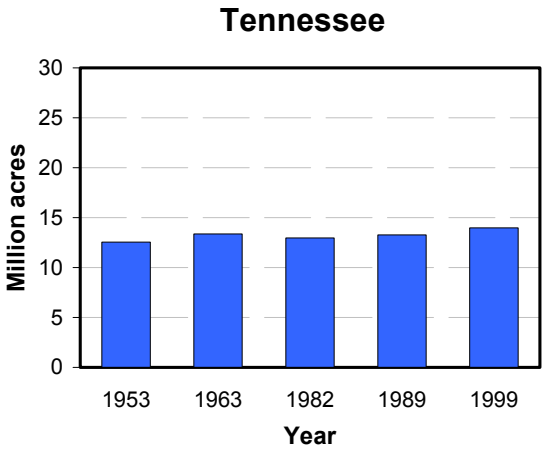


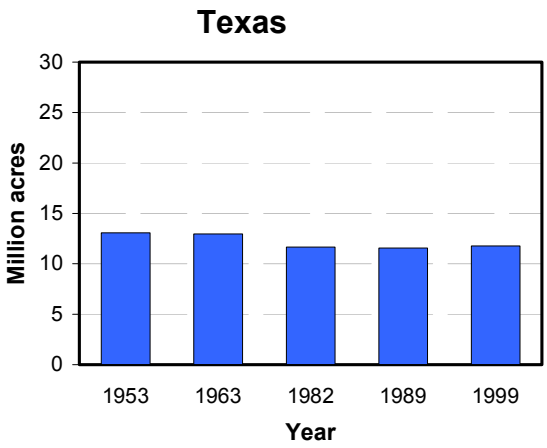

Mississippi
Million acres
30
25
20
15
10
5
0
1953
1963
1982
1989
1999
Year


North Carolina
Million acres
30
25
20
15
10
5
0
1953
1963
1982
1989
1999
Year


Oklahoma
Million acres
30
25
20
15
10
5
0
1953
1963
1982
1989
1999
Year


South Carolina
Million acres
30
25
20
15
10
5
0
1953
1963
1982
1989
1999
Year


Tennessee
Million acres
30
25
20
15
10
5
0
1953
1963
1982
1989
1999
Year


Texas
Million acres
30
25
20
15
10
5
0
1953
1963
1982
1989
1999
Year

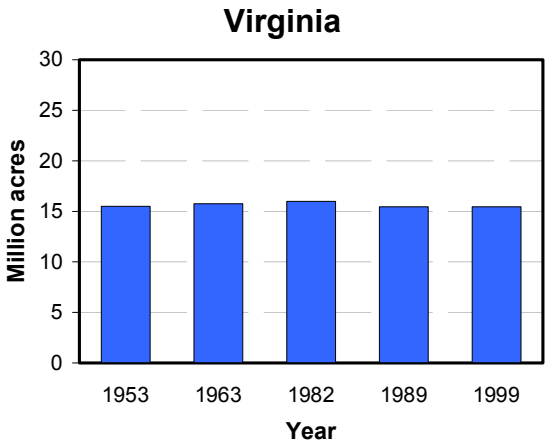


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Figure 6--Timberland area by State, ownership class and year, Southern United States.

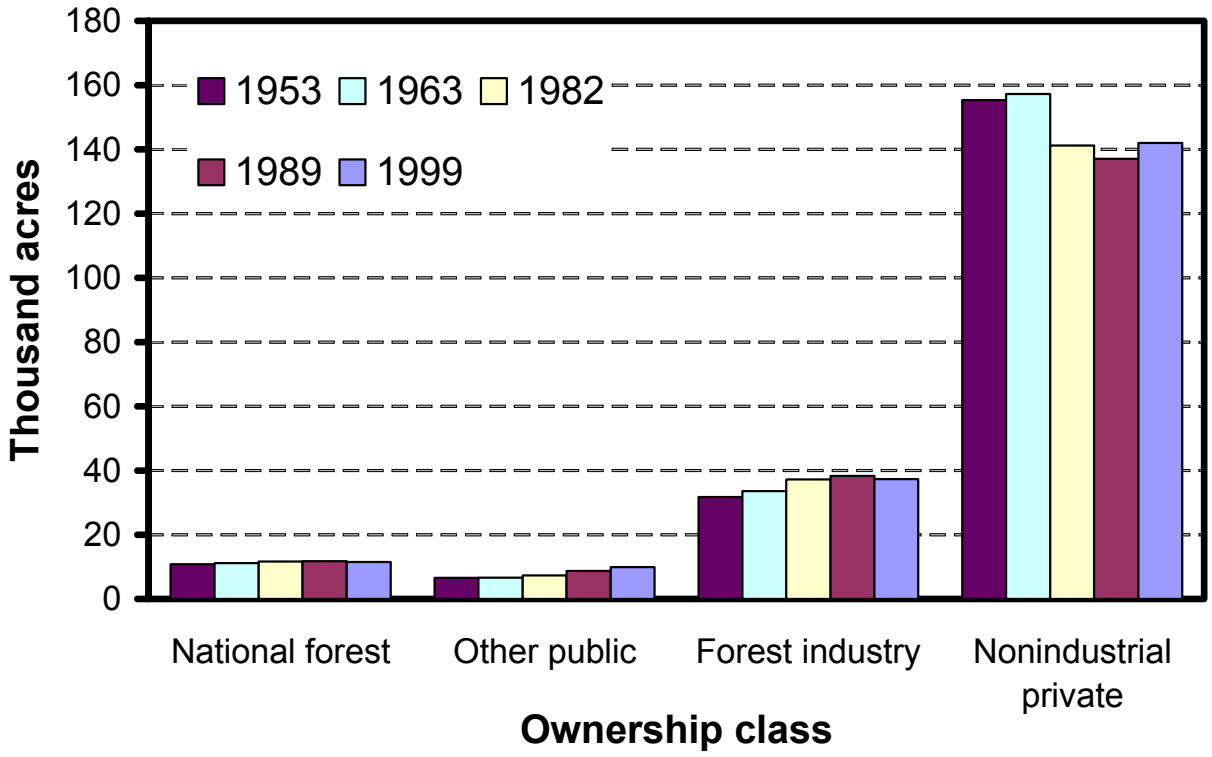

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Figure 7--Trends in nonindustrial private timberland area by ownership class and year, Southern United States (excludes Kentucky)(The previous estimate of timberland in Tennessee owned by farmers was used to represent the 1999 inventory).

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Figure 8--Area of nonindustrial private forest land by forest tract-size for the most recent surveys of Florida, Georgia, South Carolina, Tennessee, and Virginia.

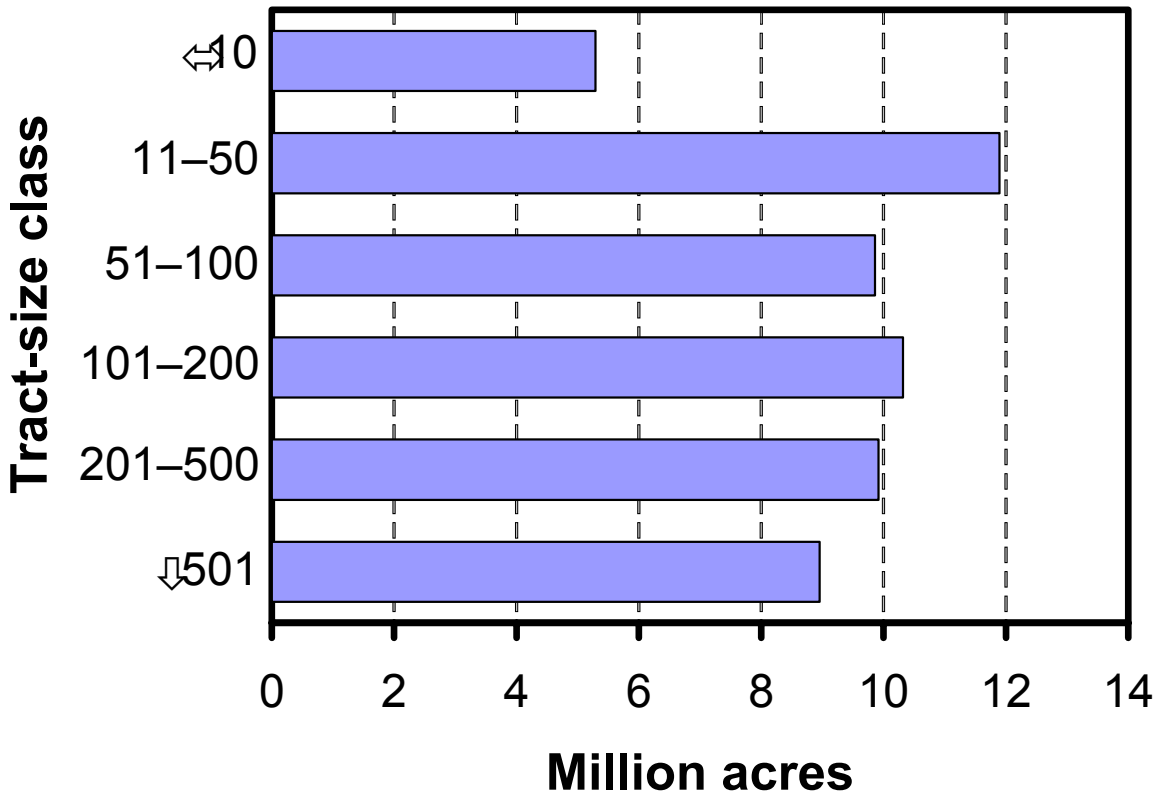

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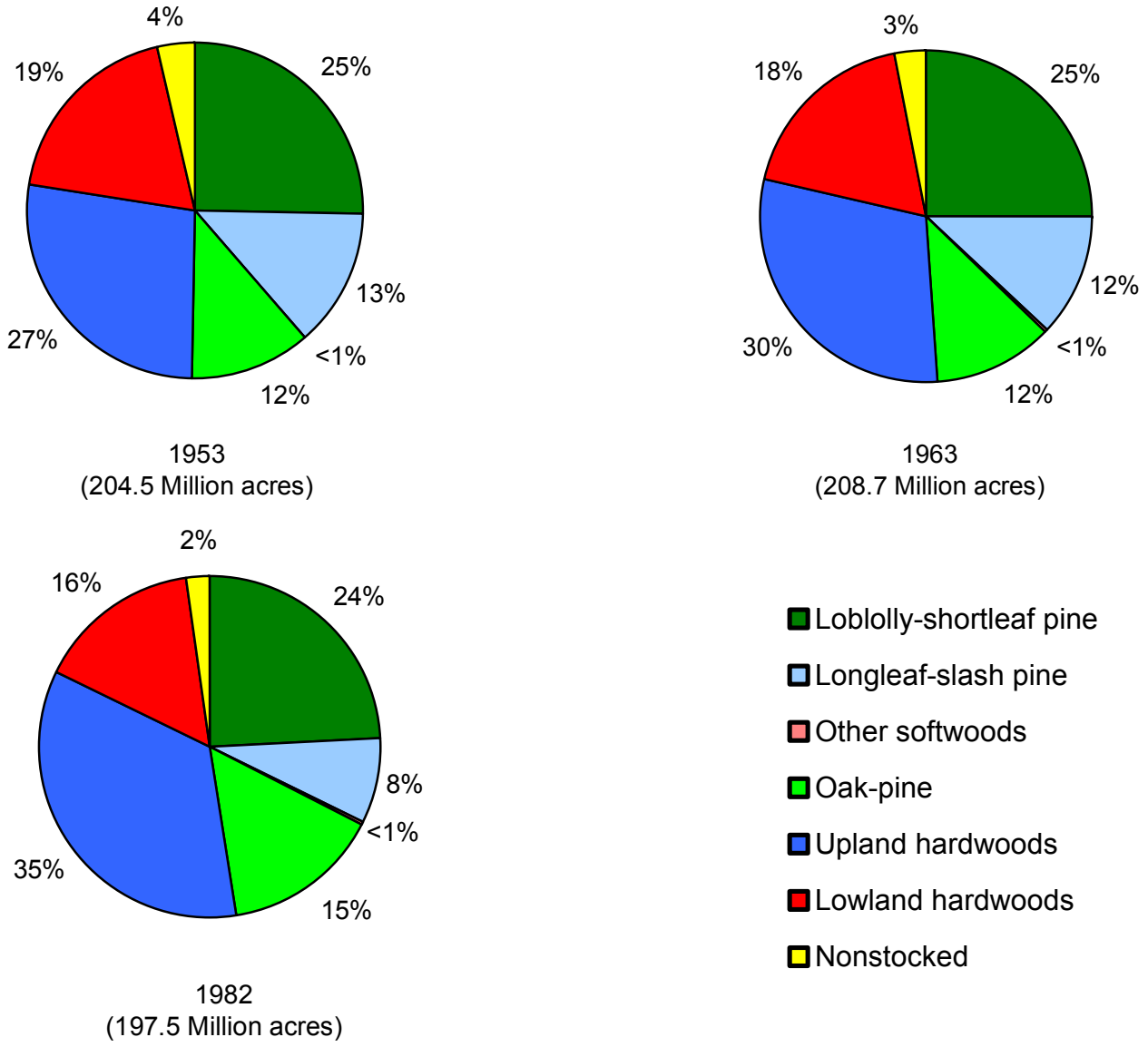
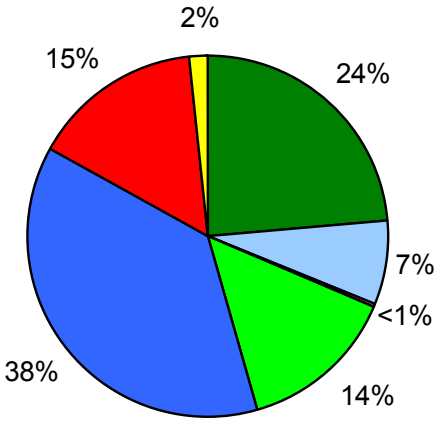
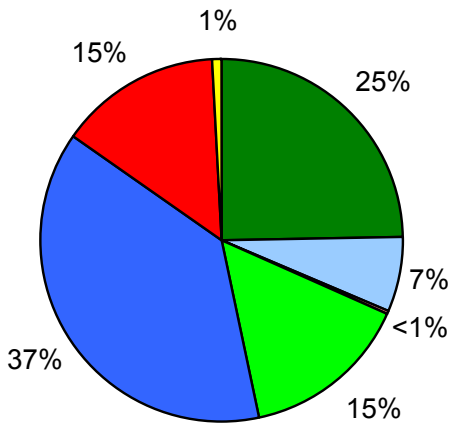
Figure 9--Percent distribution of timberland by forest type group and year, Southern United States.





1989
(195.9 Million acres)



1999
(200.7 Million acres)

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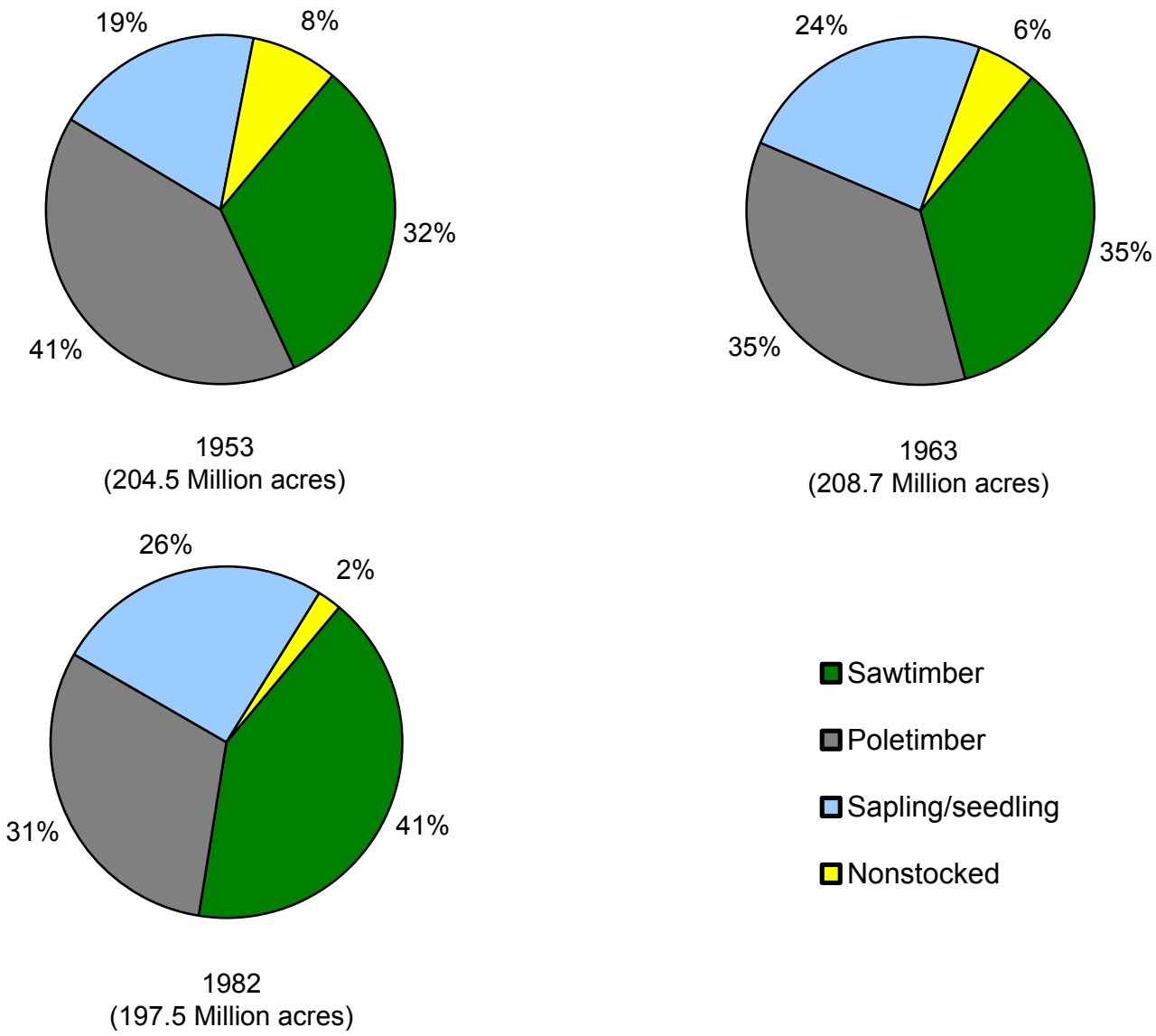
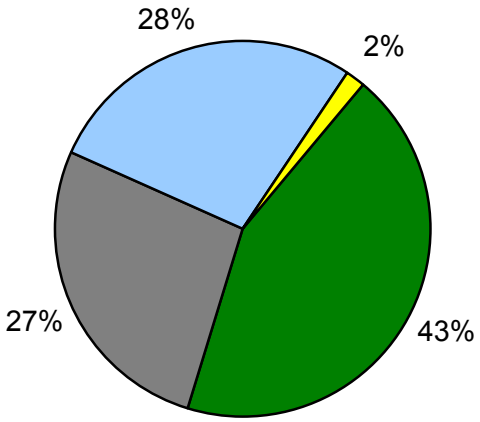
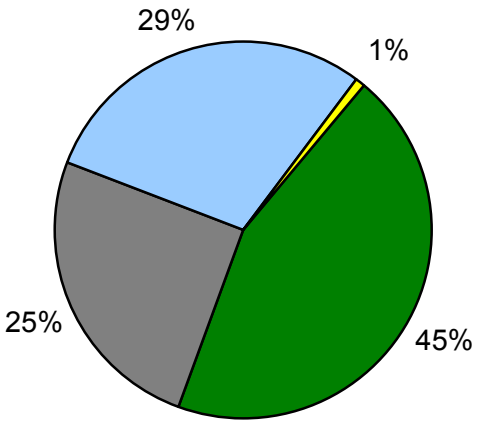
Figure 10--Percent distribution of timberland by stand-size class and year, Southern United States. (excludes Kentucky).





1989
(195.9 Million acres)



1999
(200.7 Million acres)

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Figure 11--Distribution of timberland by forest management type, Southern United States, 1999.

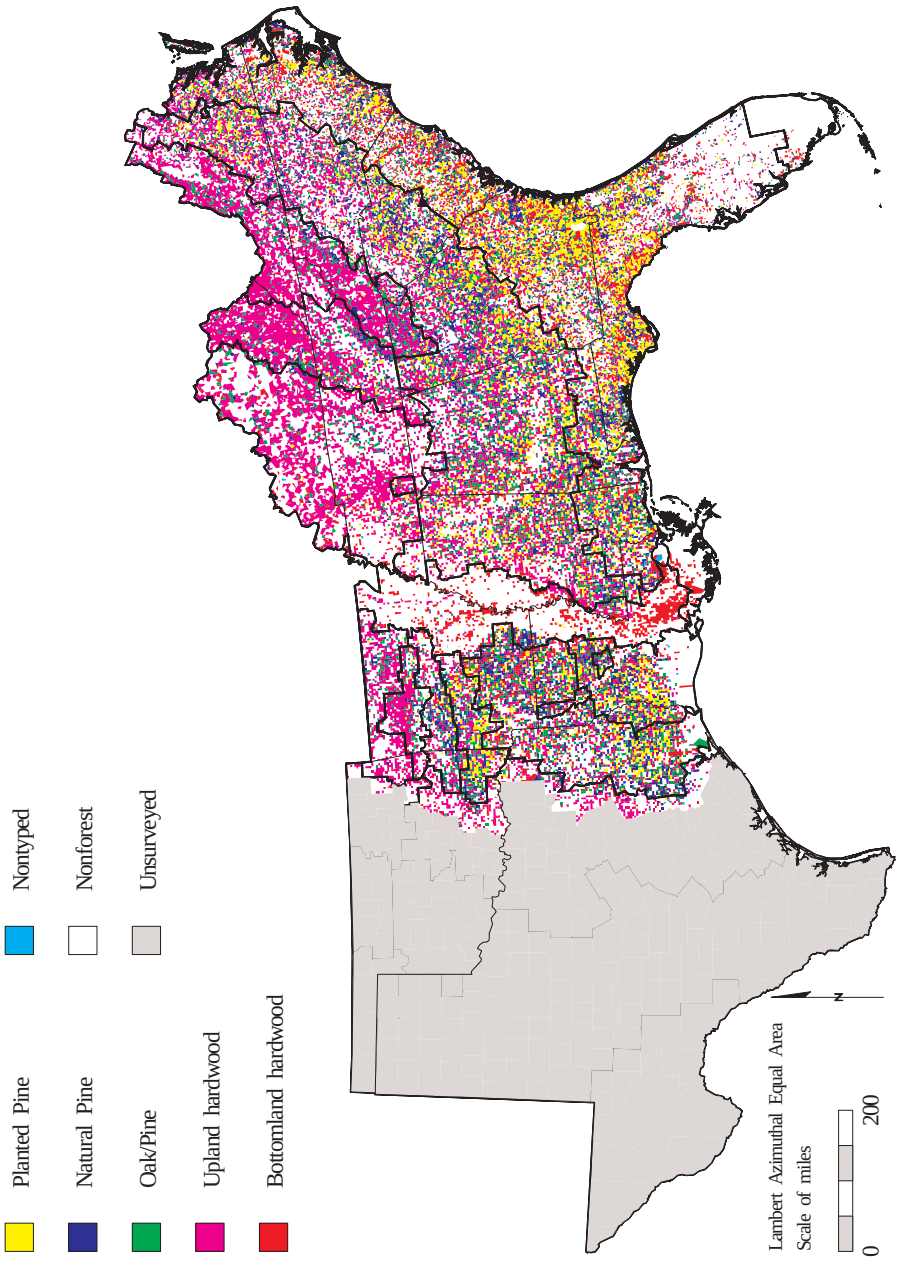

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Figure 12--Trends in area of timberland by broad management type, Southern United States, 1952-1999.

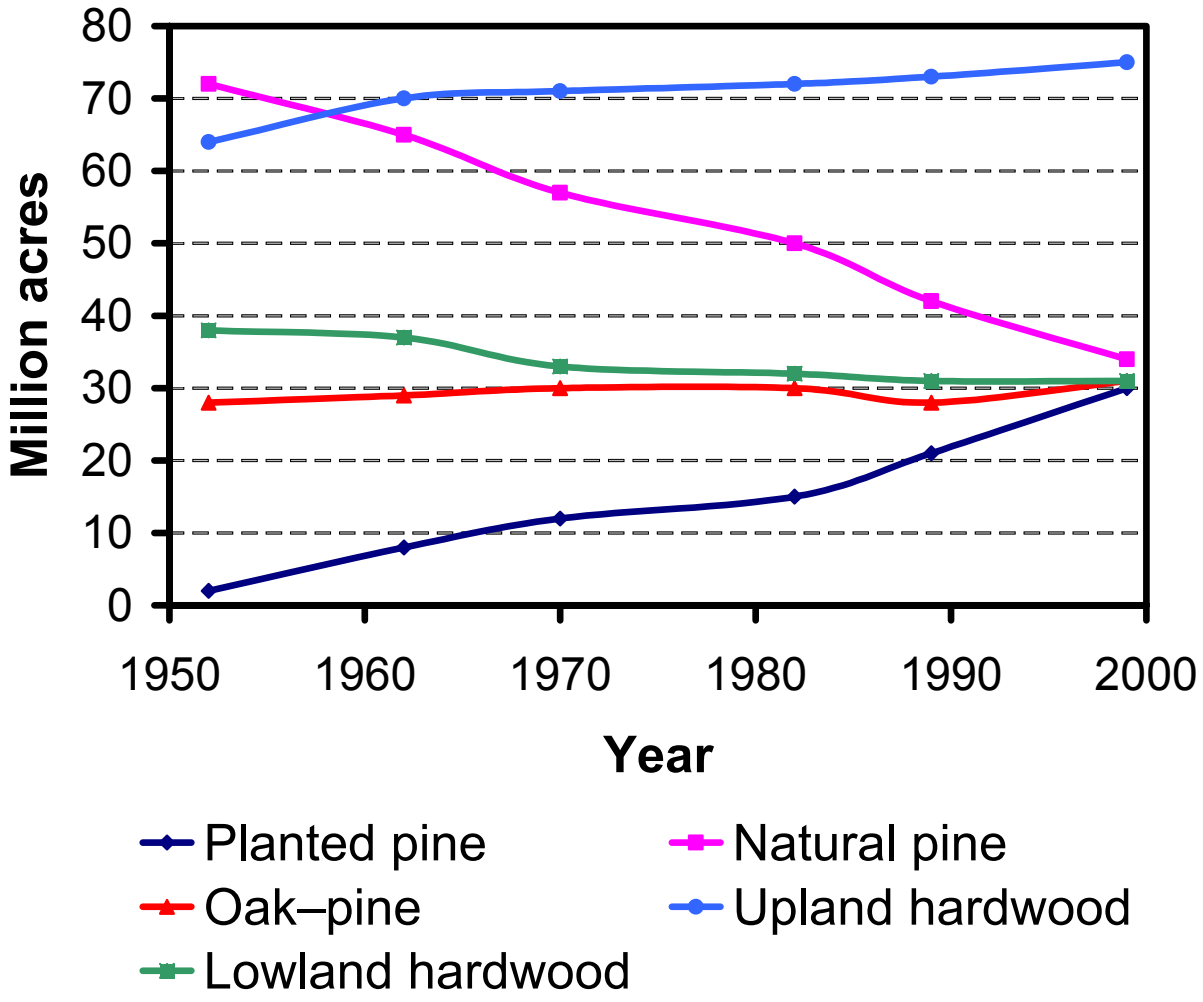

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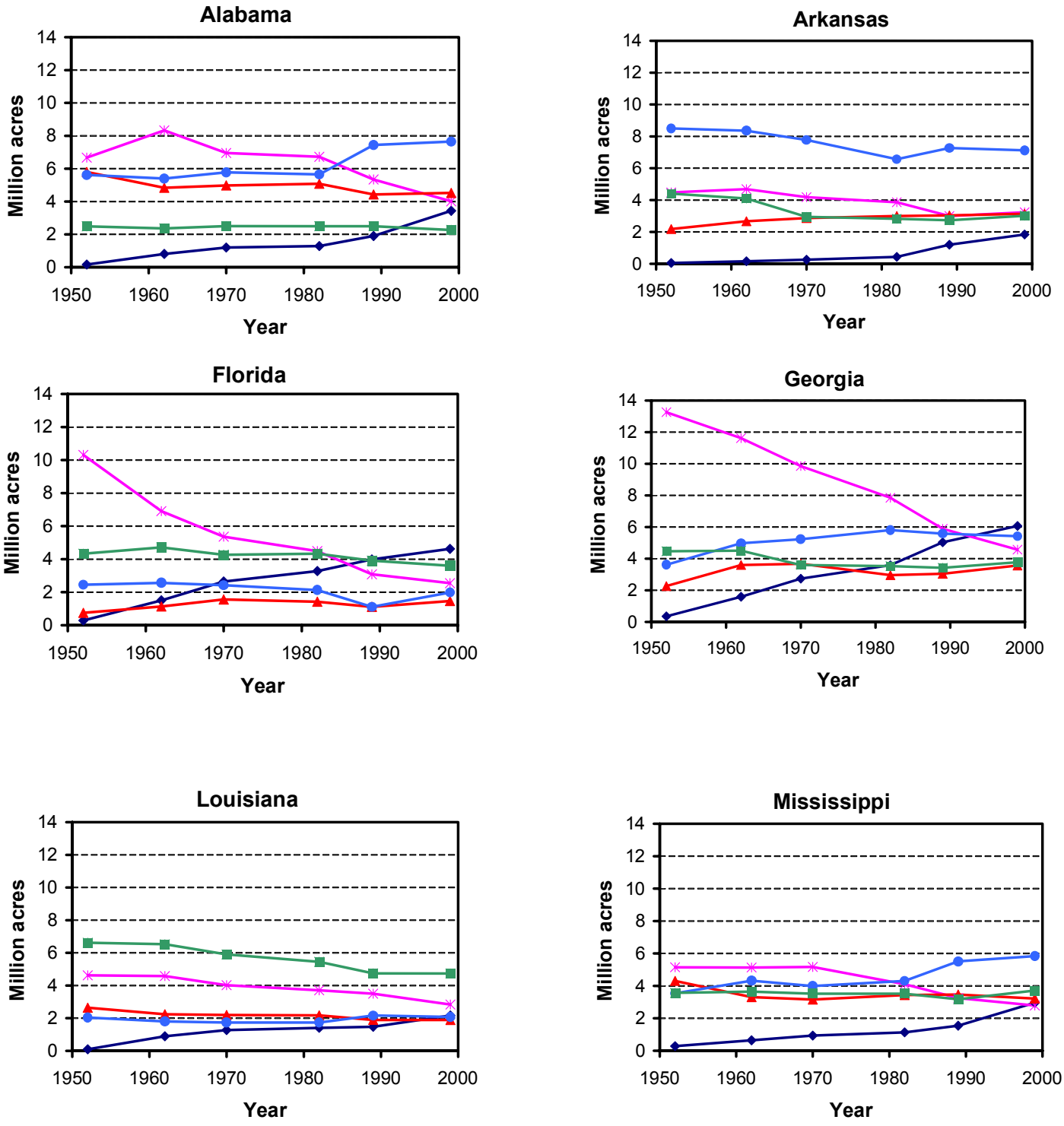
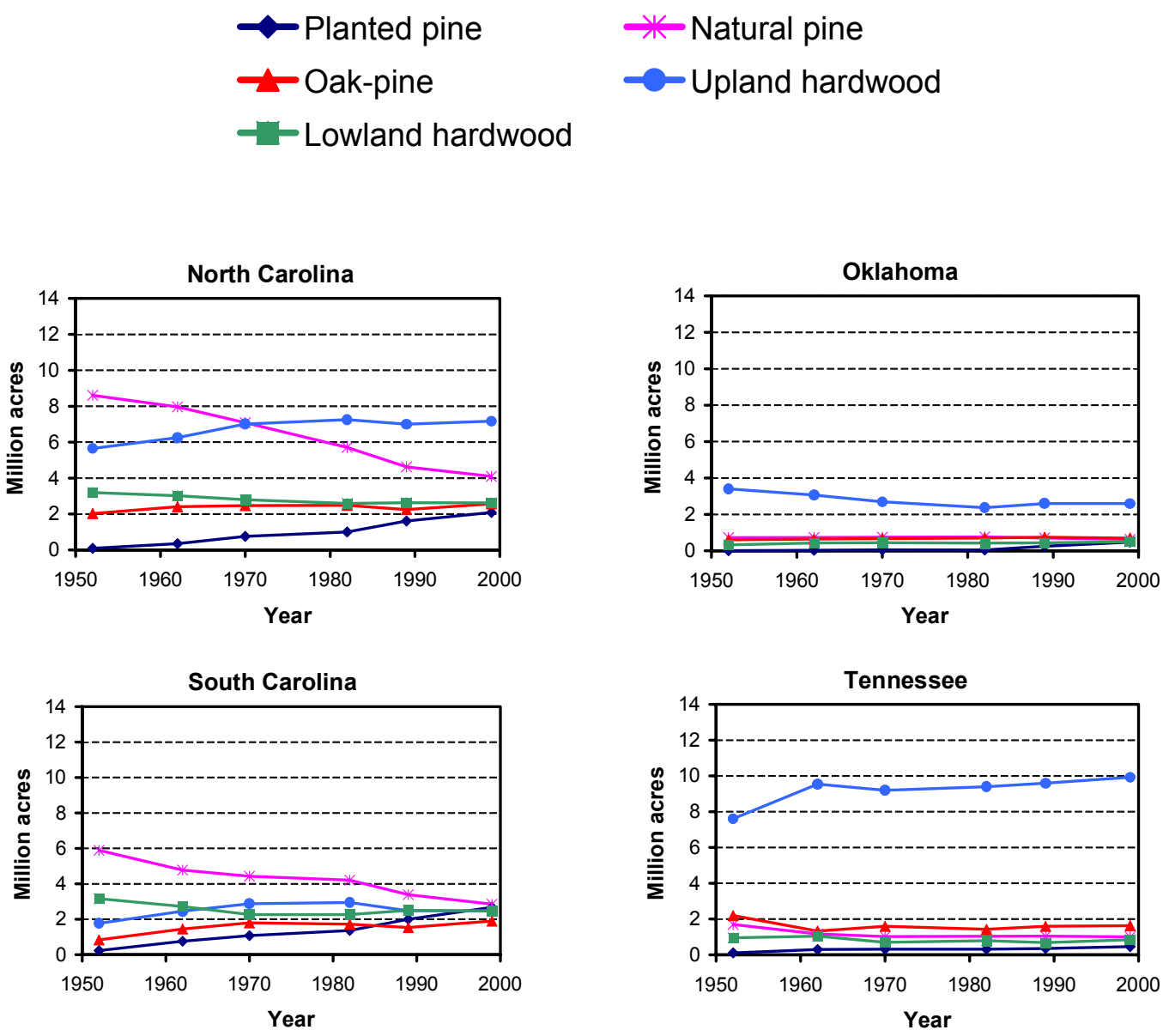
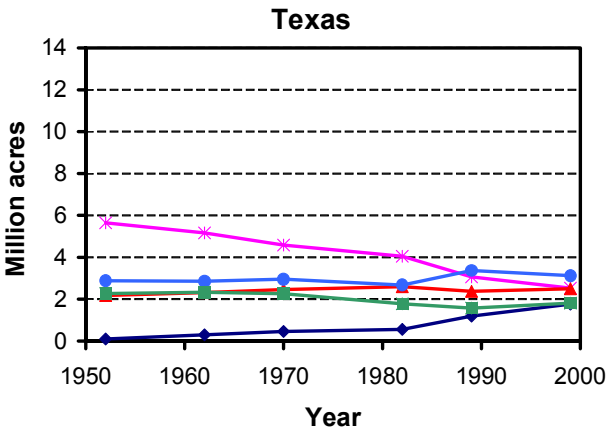
Figure 13--Trends in timberland area by State, year and forest management type, Southern United States (exclude Kentucky).




Planted pine
Natural pine
Oak-pine
Upland hardwood
Lowland hardwood
North Carolina
Oklahoma
South Carolina
Tennessee
Million acres
Year
0
2
4
6
8
10
12
14
1950
1960
1970
1980
1990
2000



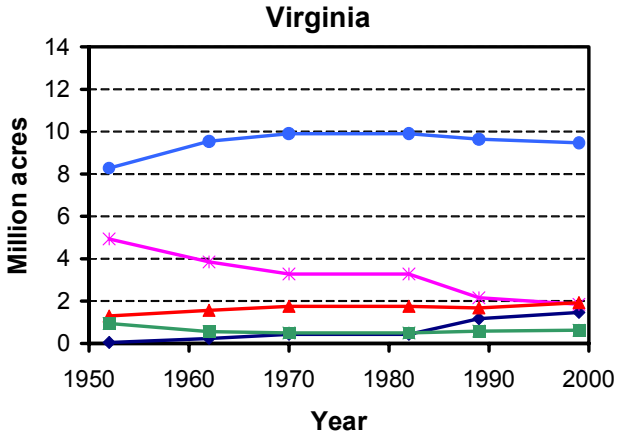


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Figure 14--Percent distribution of timberland area within forest management types, by stand-age class, Southern United States, 1999.

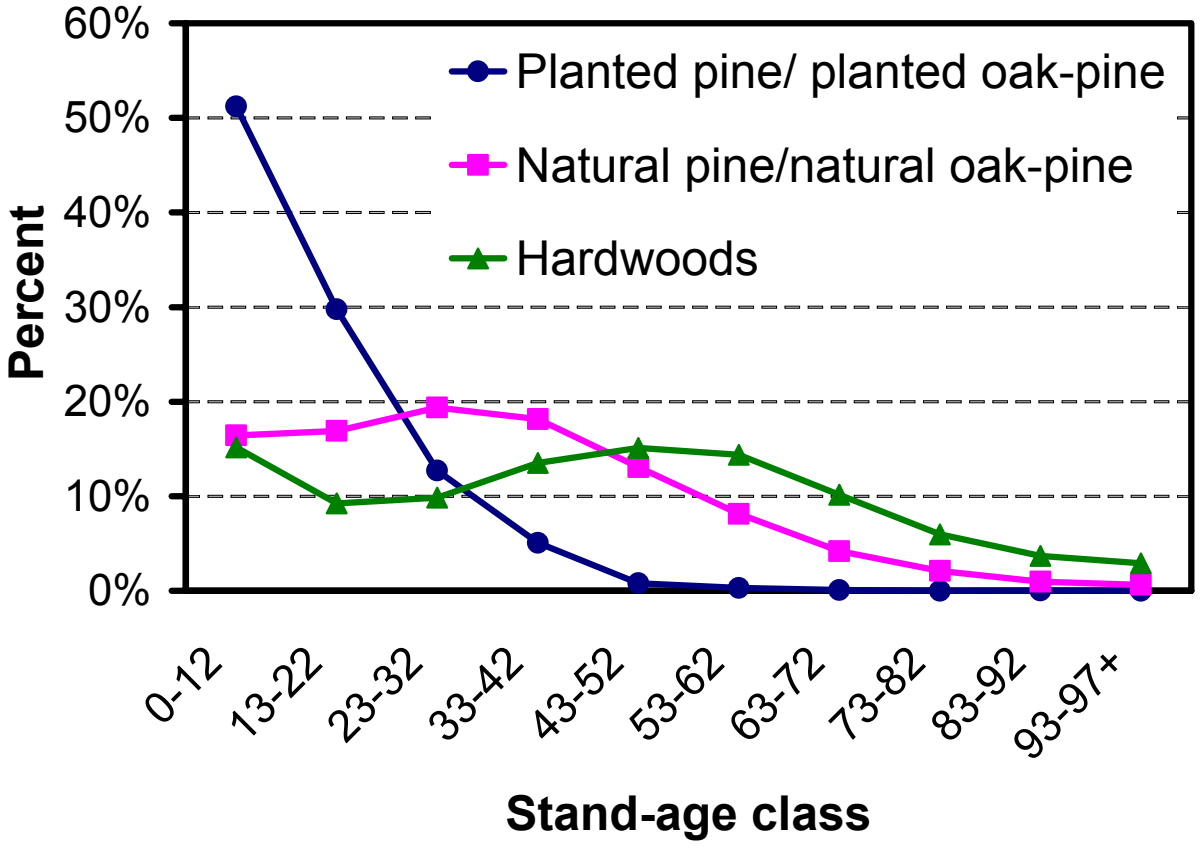

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Figure 15--Volume of growing-stock on timberland by softwood, hardwood, and year, Southern United States.

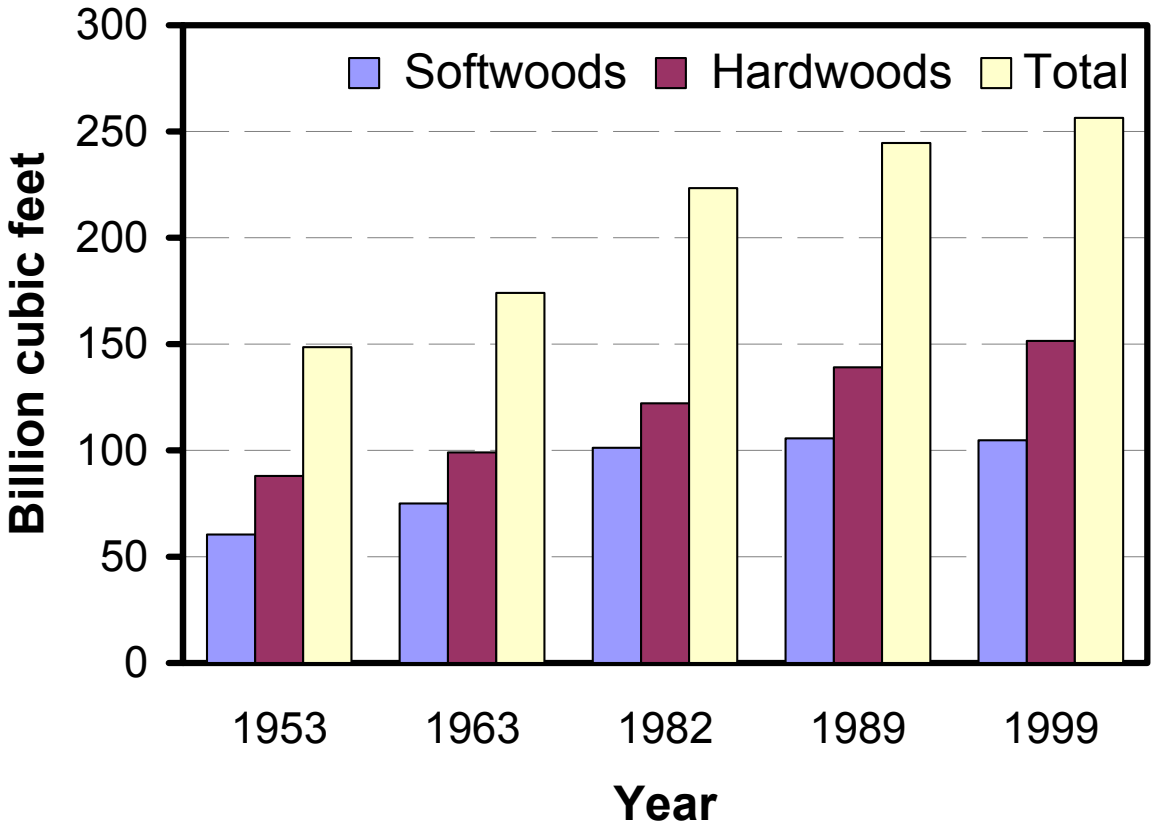

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Figure 16--Volume of growing stock on timberland by diameter class and year, Southern United States.

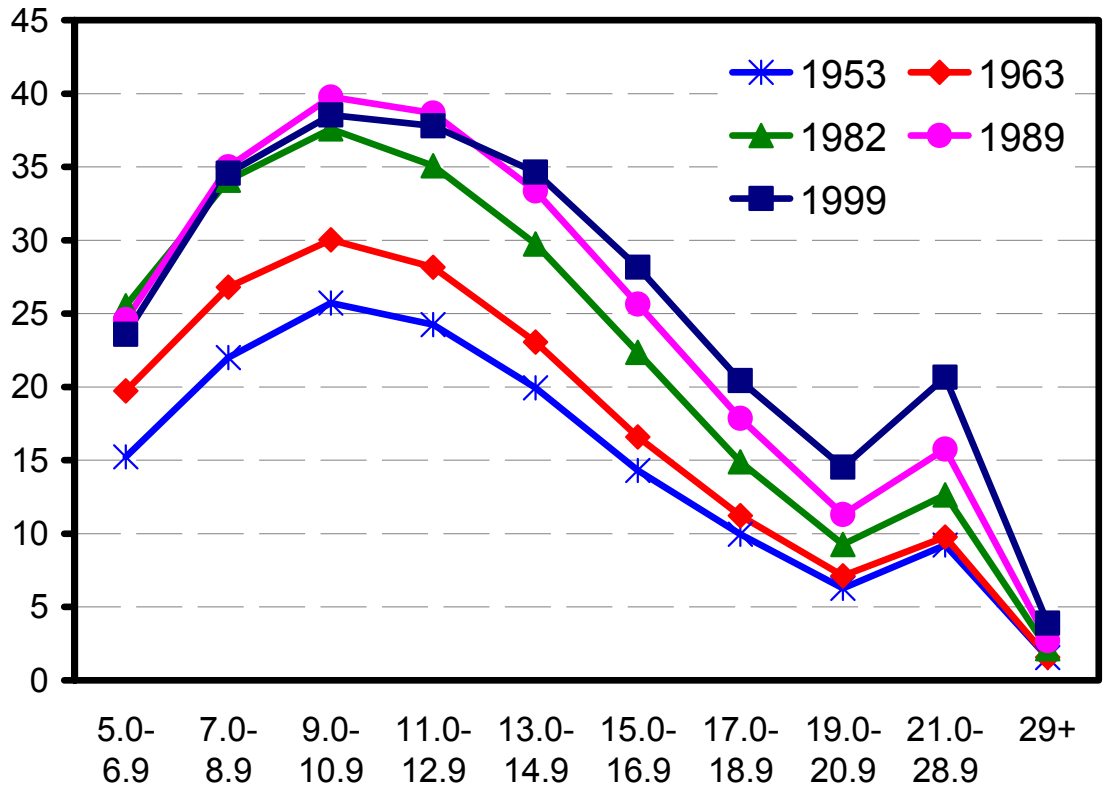

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Figure 17--Volume of softwood growing stock on timberland by diameter class and year, Southern United States.

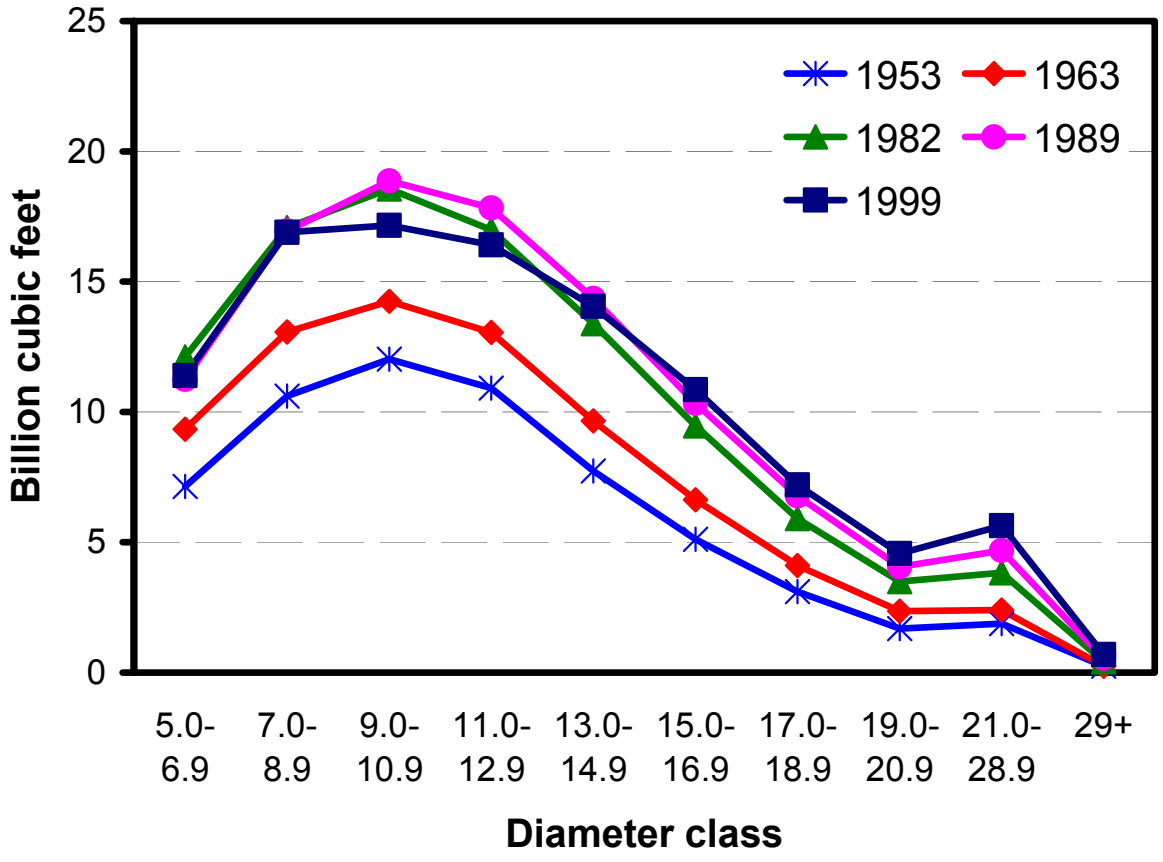

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Figure 18--Volume of hardwood growing stock on timberland by diameter class and year, Southern United States.

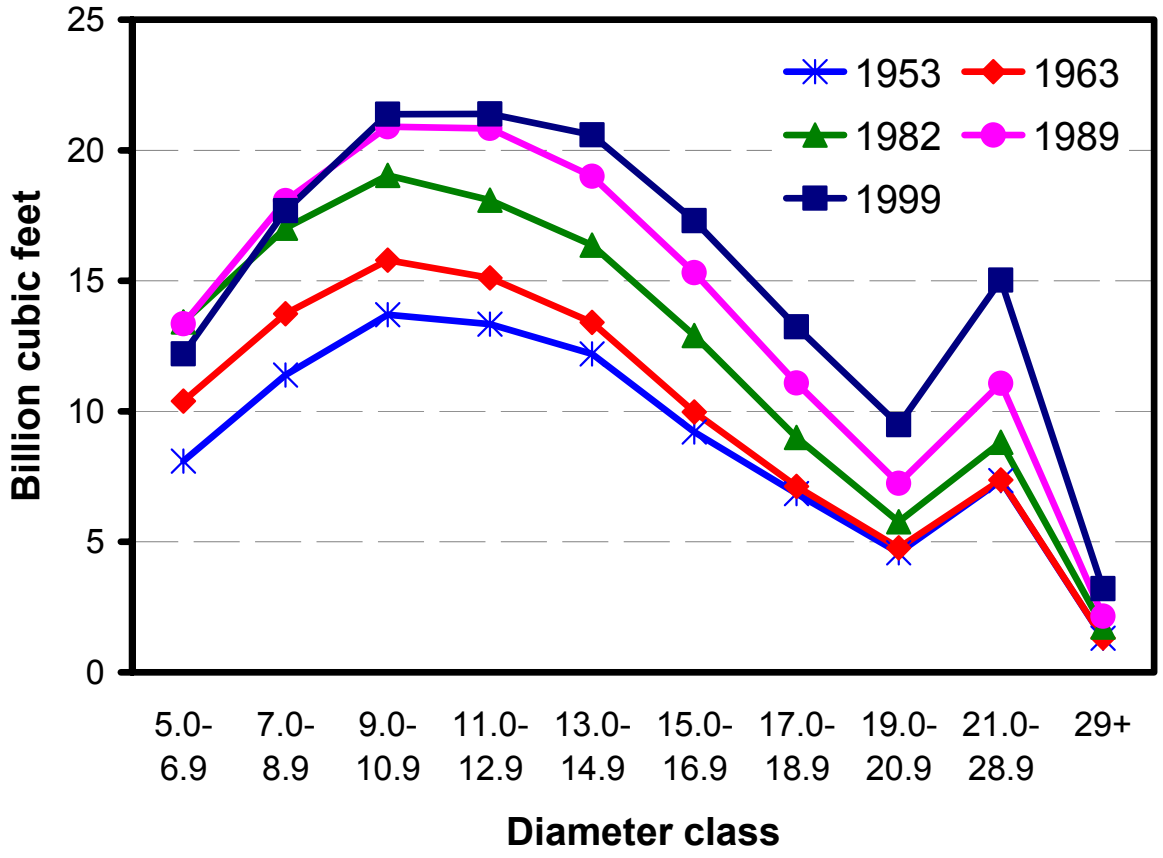

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Figure 19--Volume of growing stock on timberland by ownership class and year, Southern United States.

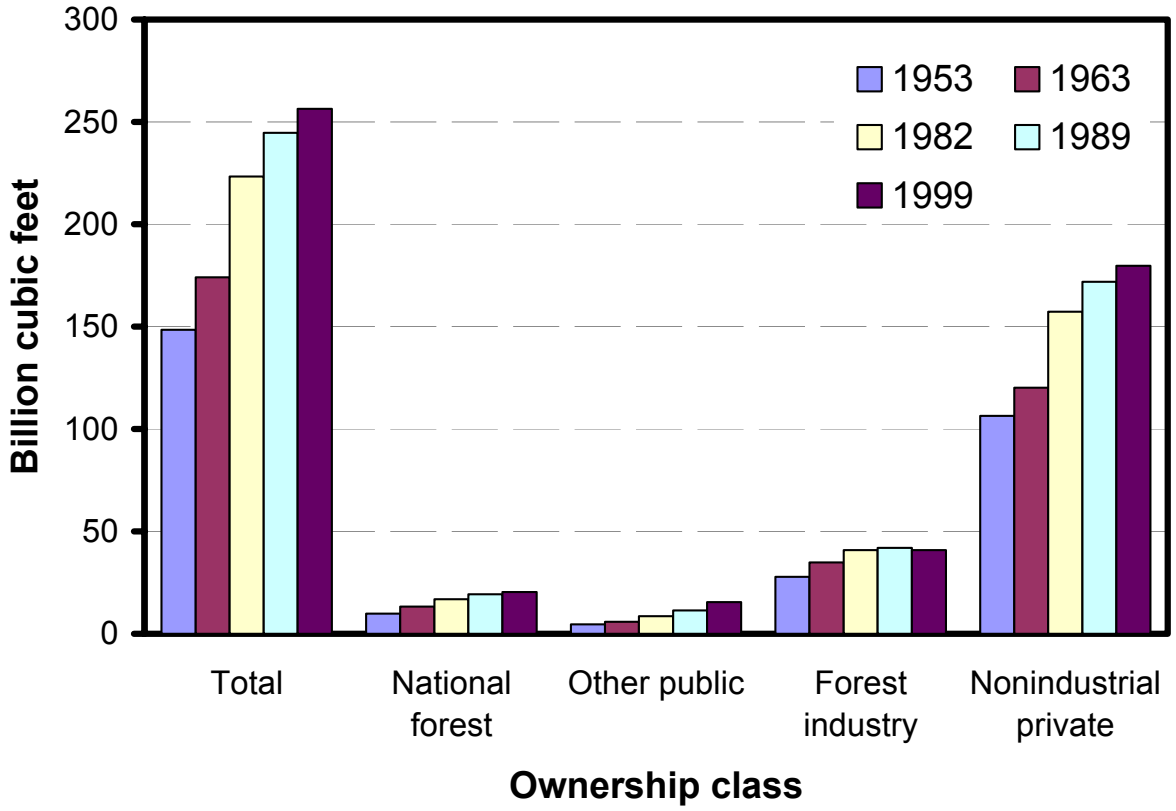

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Figure 20--Volume of growing-stock on timberland by forest-type group and year, Southern United States.

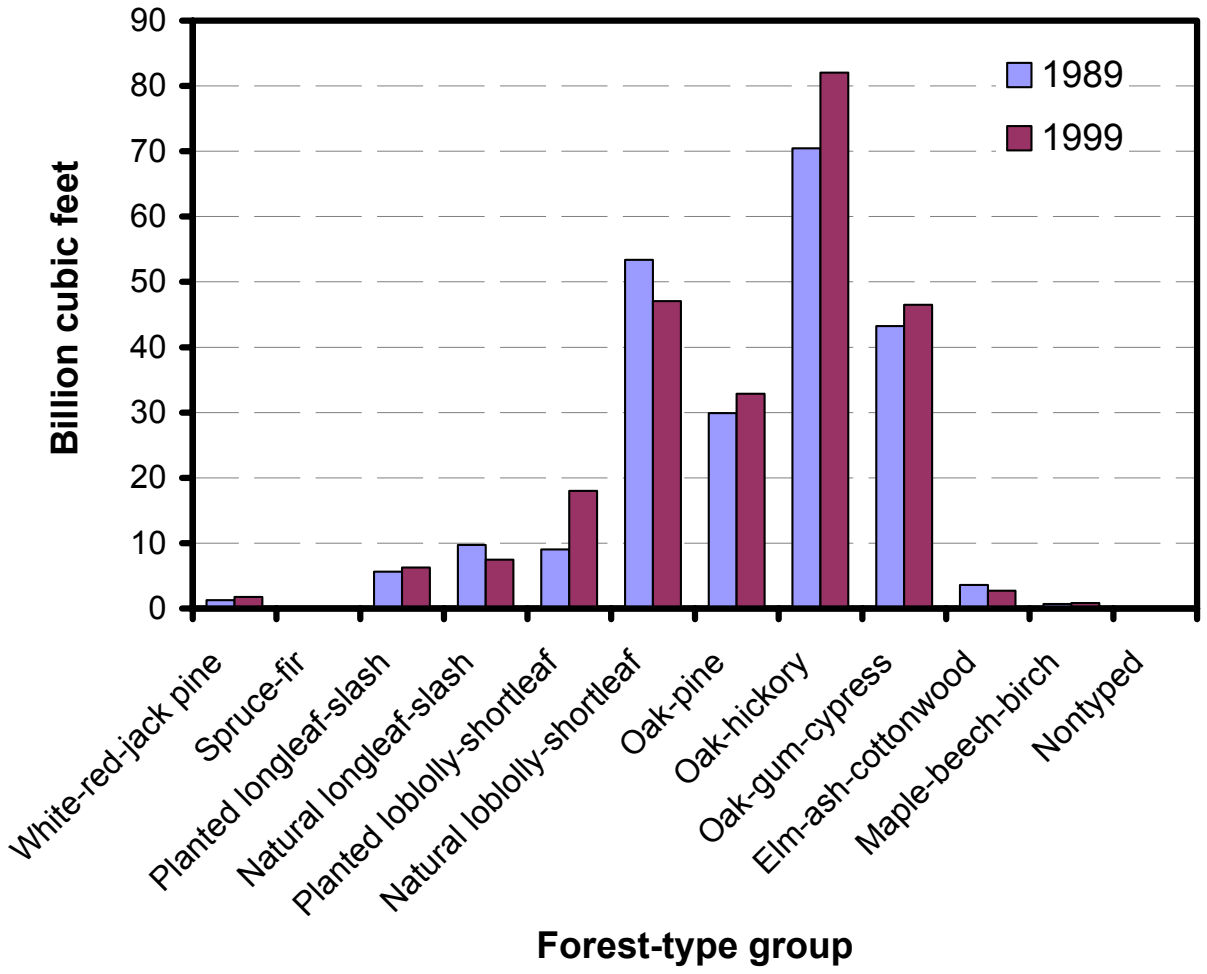

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Figure 21--Average annual growth of growing-stock on timberland by softwood, hardwood, and year, Southern United States.

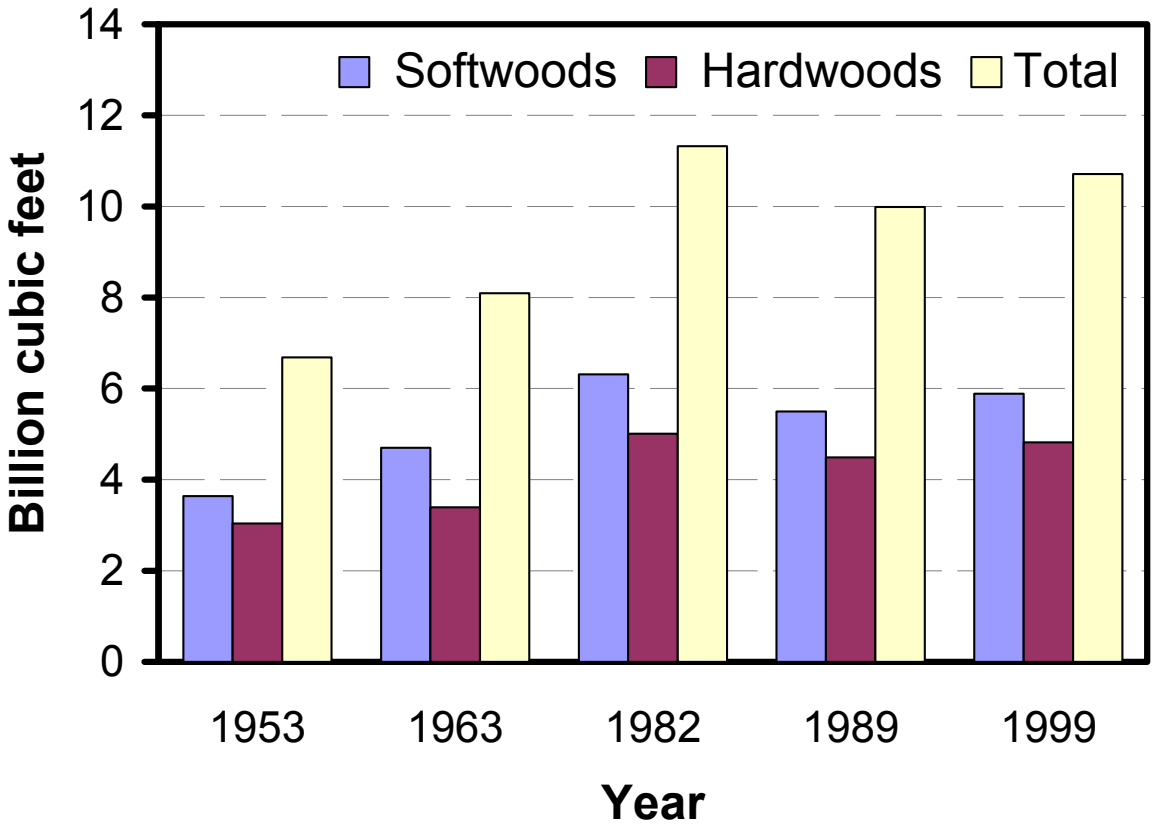

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Figure 22--Rate of average annual growth of softwoods and hardwoods expressed as a percentage of growing stock, Southern United States.

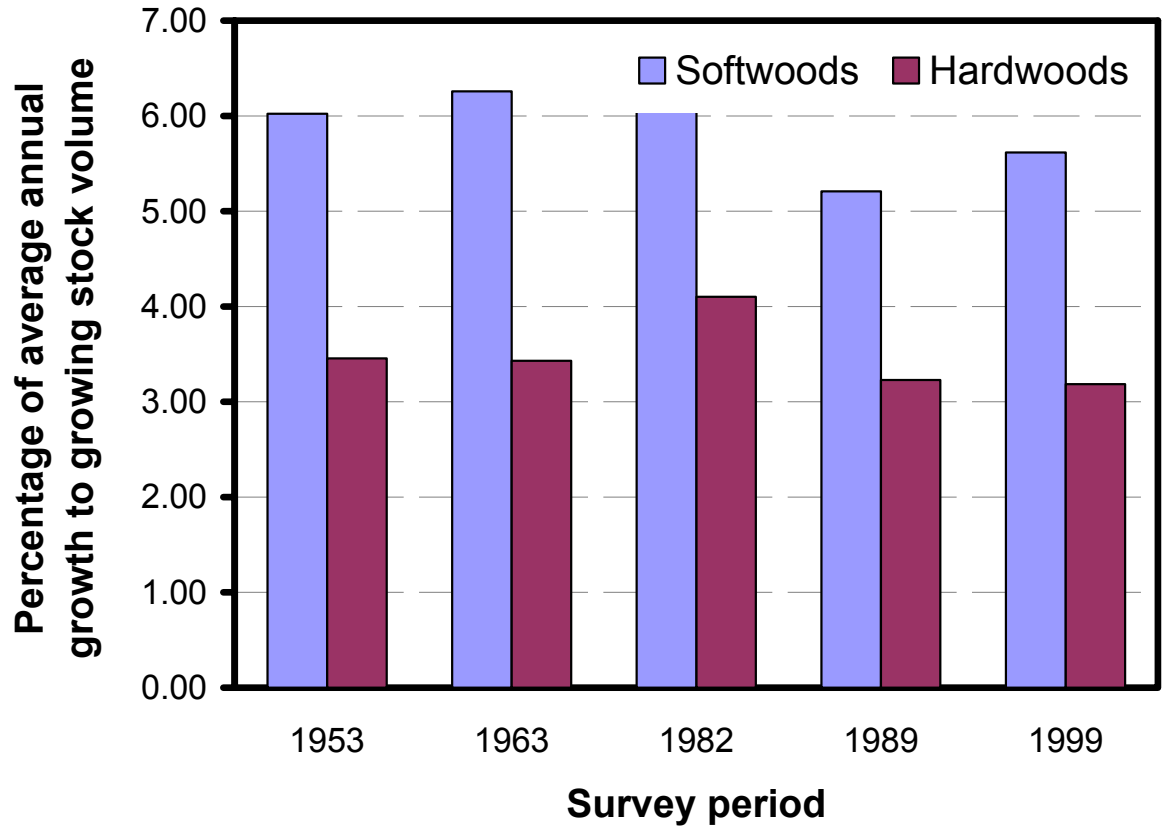

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Figure 23--Average annual growth of growing-stock on timberland by ownership class and year, Southern United States.

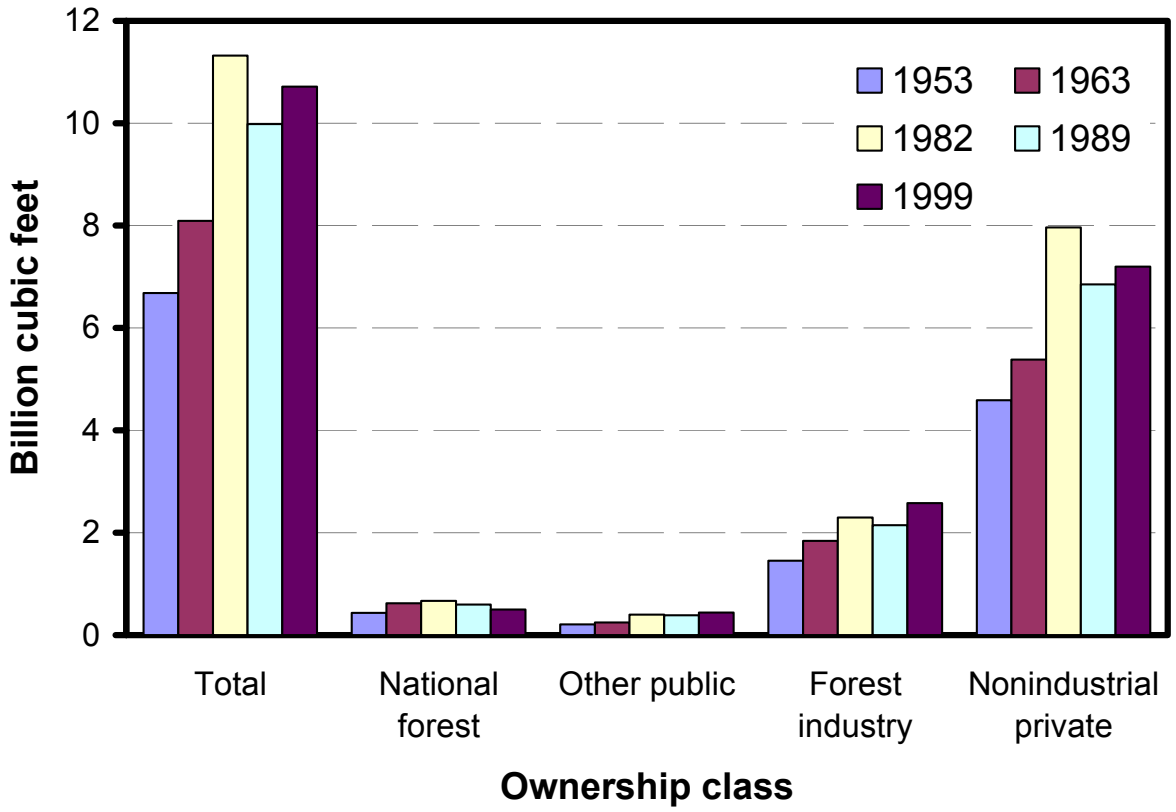

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Figure 24--Average annual growth of growing stock on timberland by forest-type group and year, Southern United States.

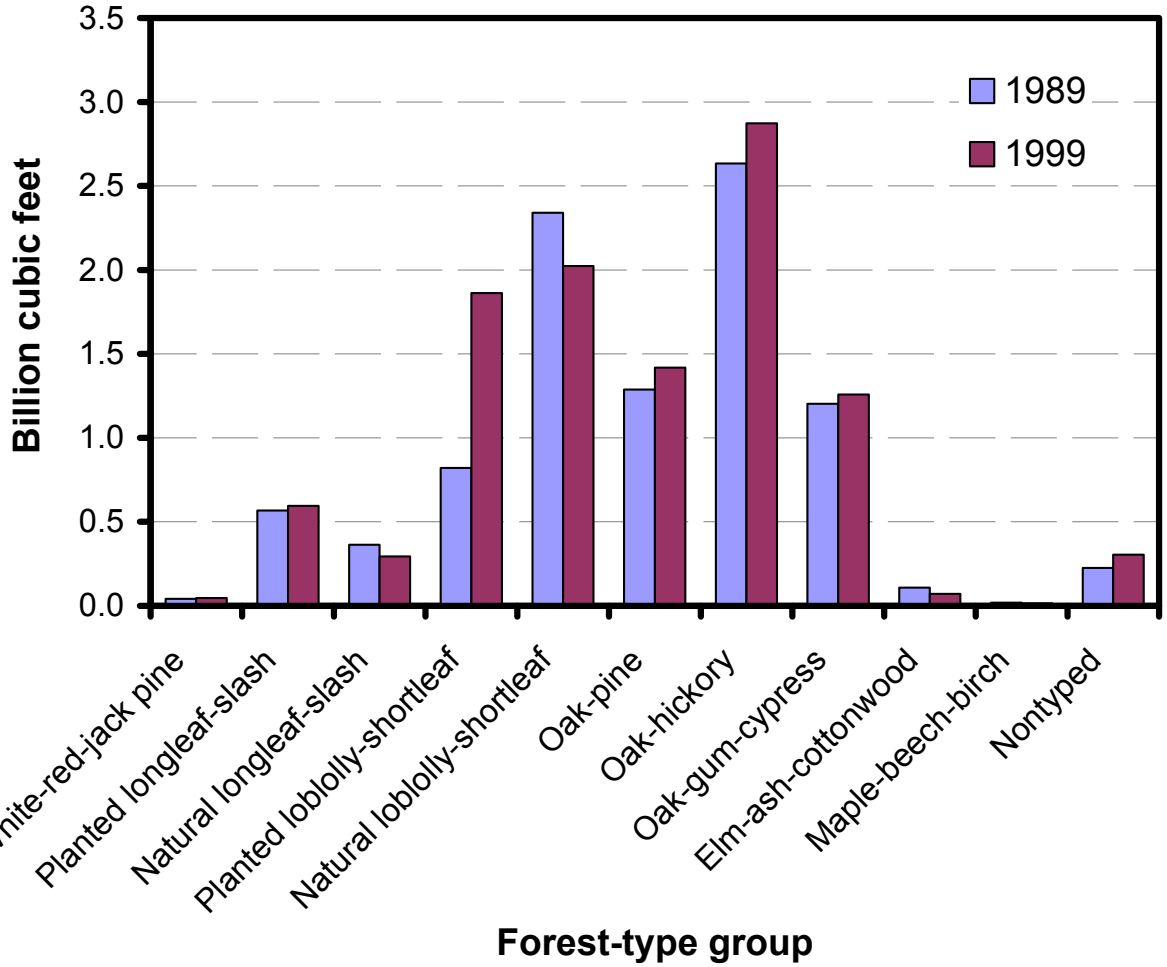

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Figure 25--Average annual removals of growing stock on timberland by softwood, hardwood, and year, Southern United States.

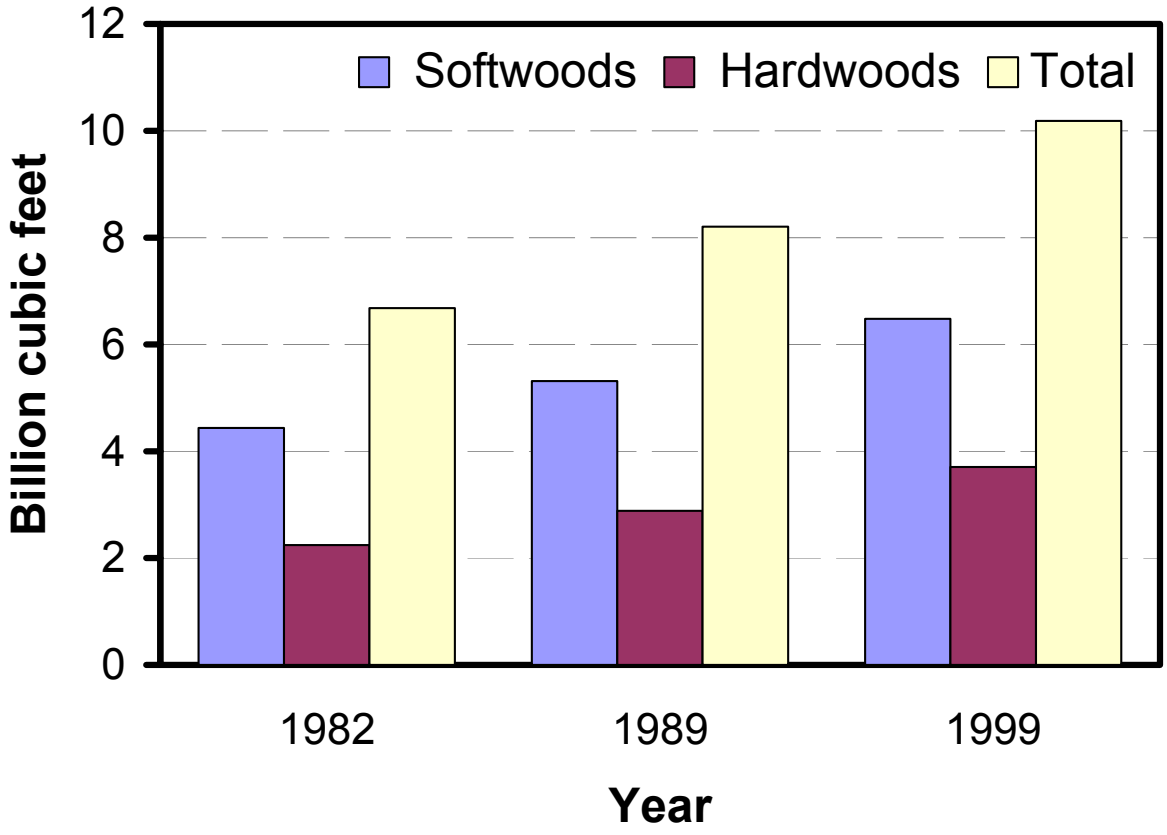

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Figure 26--Rate of average annual removals of softwoods and hardwoods expressed as a percentage of growing stock, Southern United States.

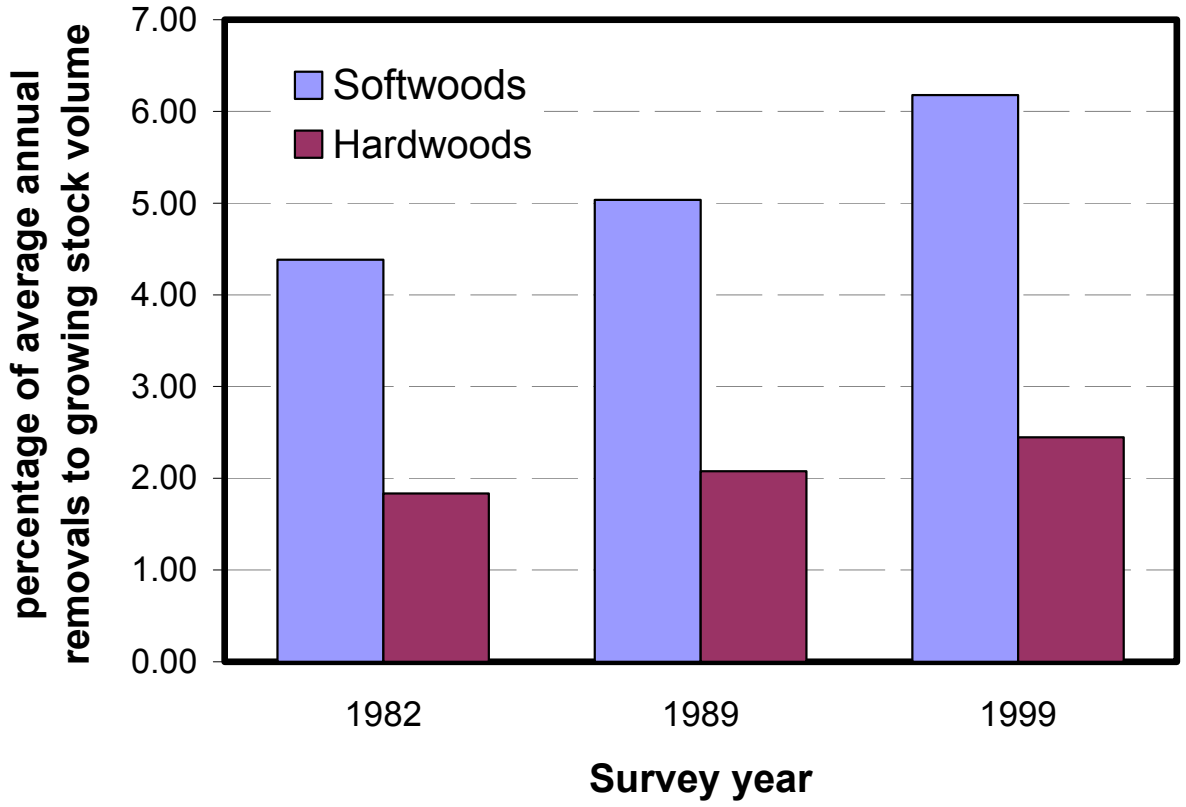

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Figure 27--Average annual removals of growing-stock on timberland by ownership class and year, Southern United States.

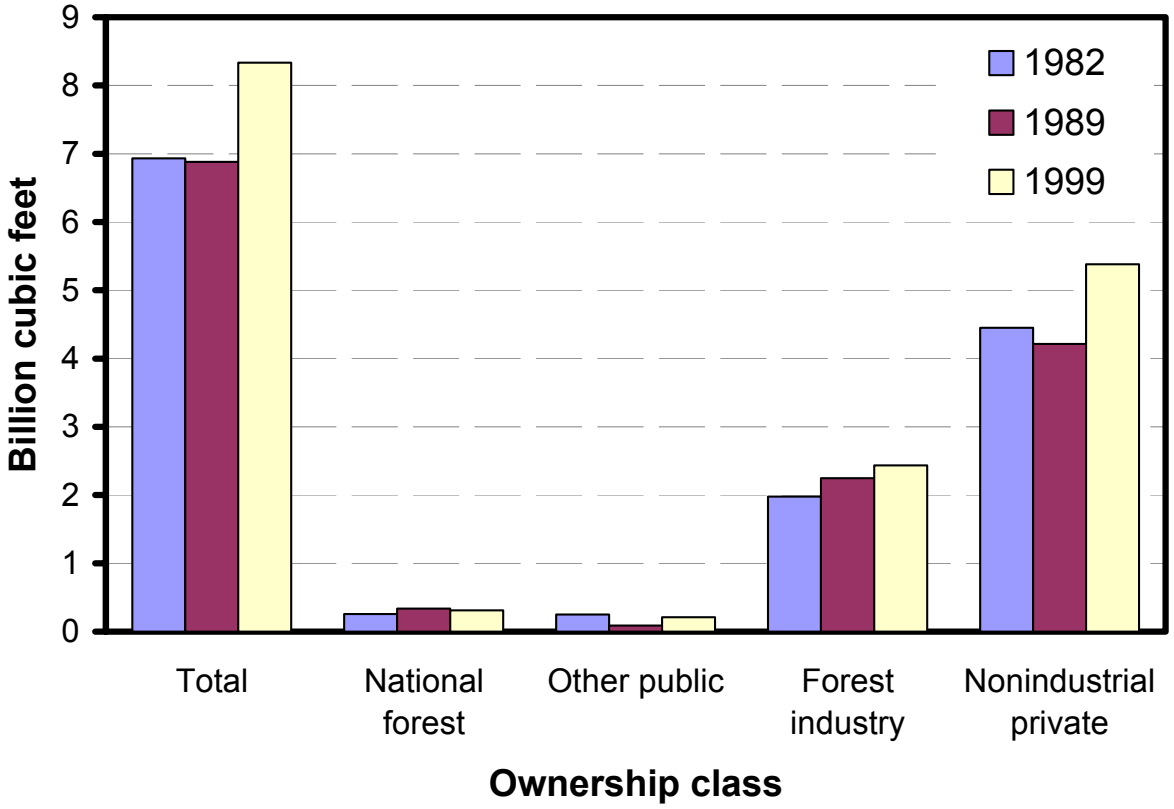

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Figure 28--Average annual removals of growing-stock on timberland by forest-type group and year, Southern United States.

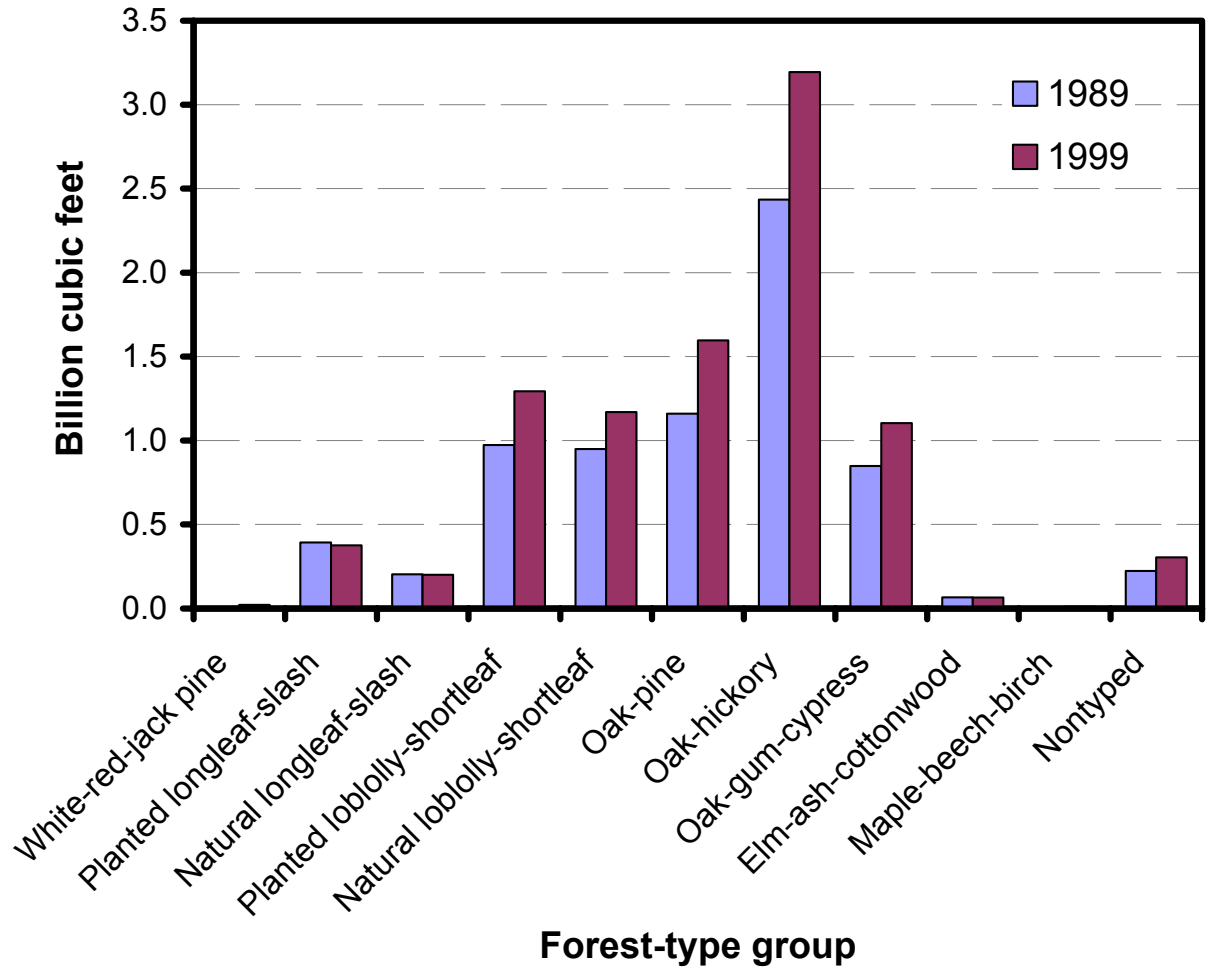

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Figure 29--Average annual mortality of growing stock on timberland by softwoods, hardwoods, and year, Southern United States.

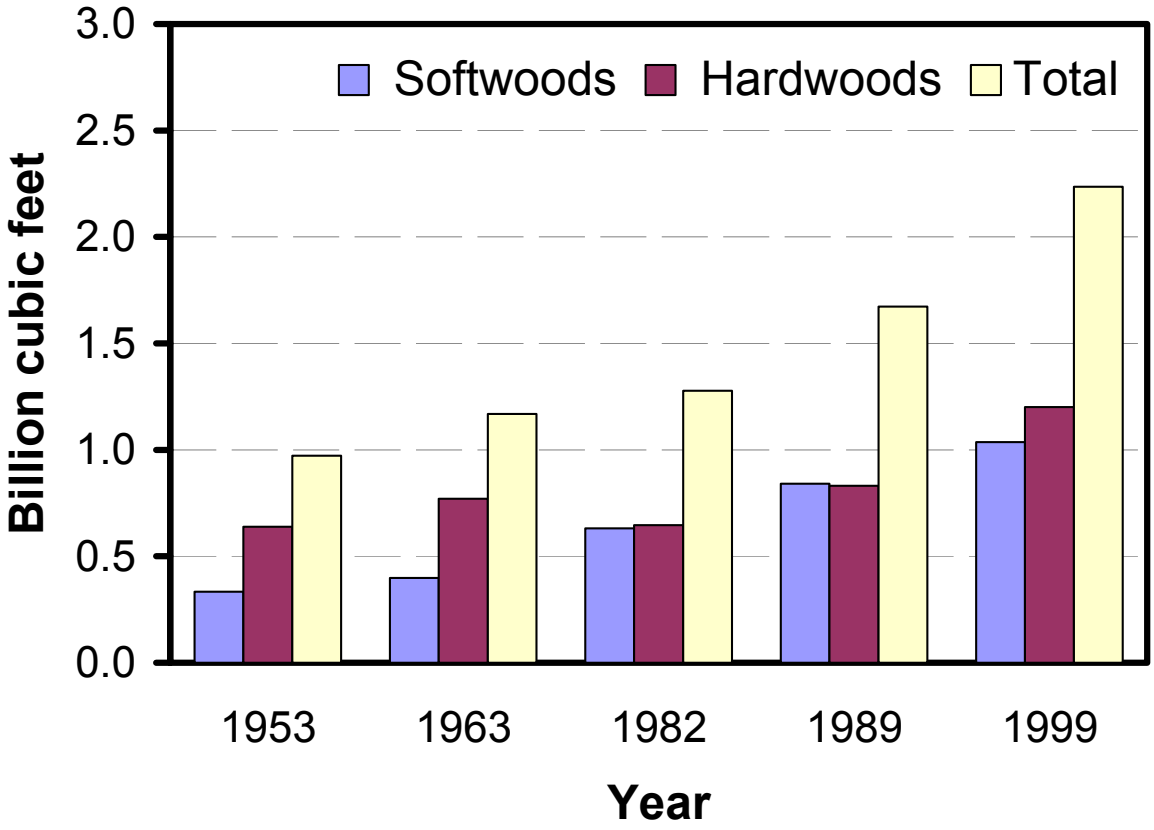

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Figure 30--Rate of average annual mortality of softwoods and hardwoods expressed as a percentage of growing stock, Southern United States.

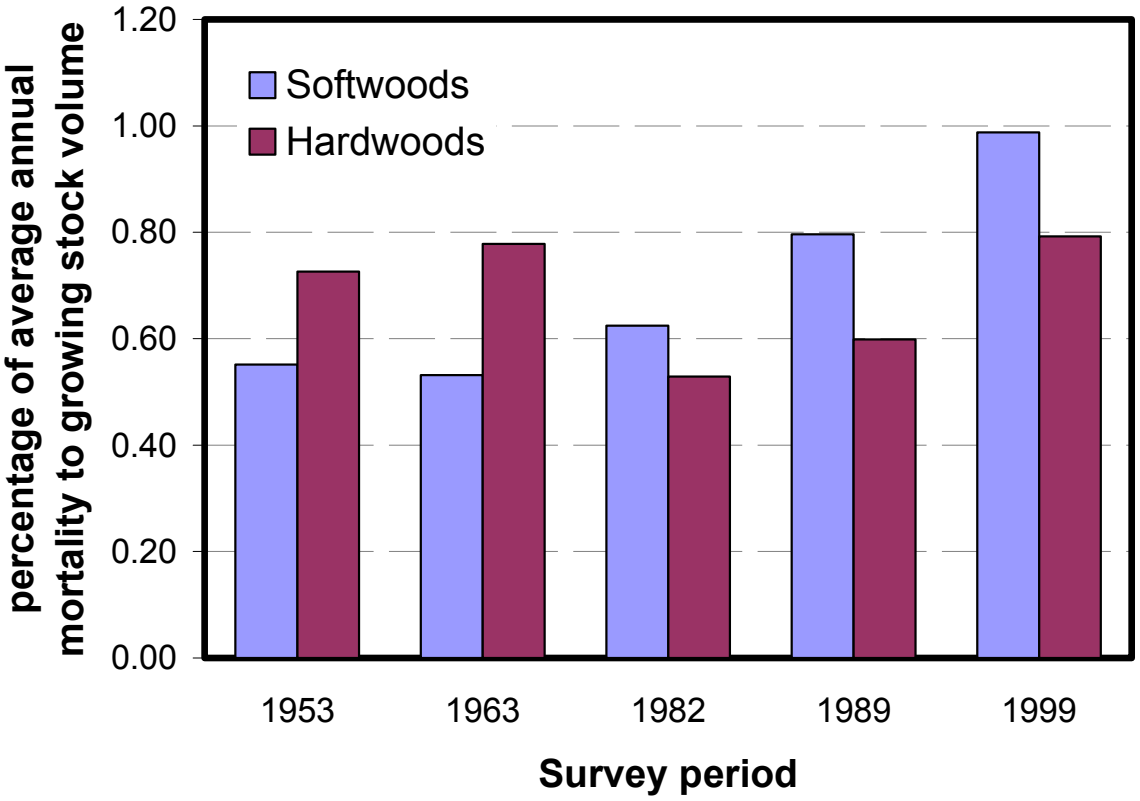

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Figure 31--Average annual mortality of growing-stock on timberland by ownership class and year, Southern United States.

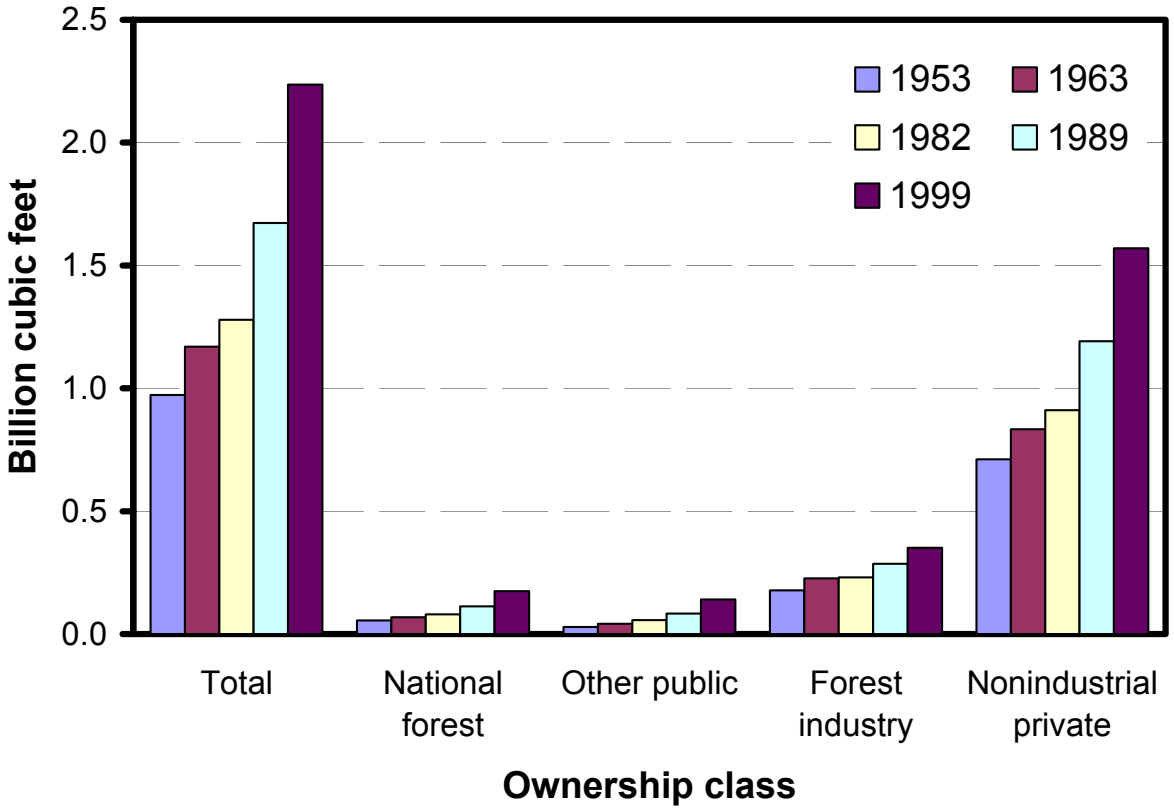

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Figure 32--Average annual mortality of growing-stock on timberland by forest-type group and year, Southern United States.

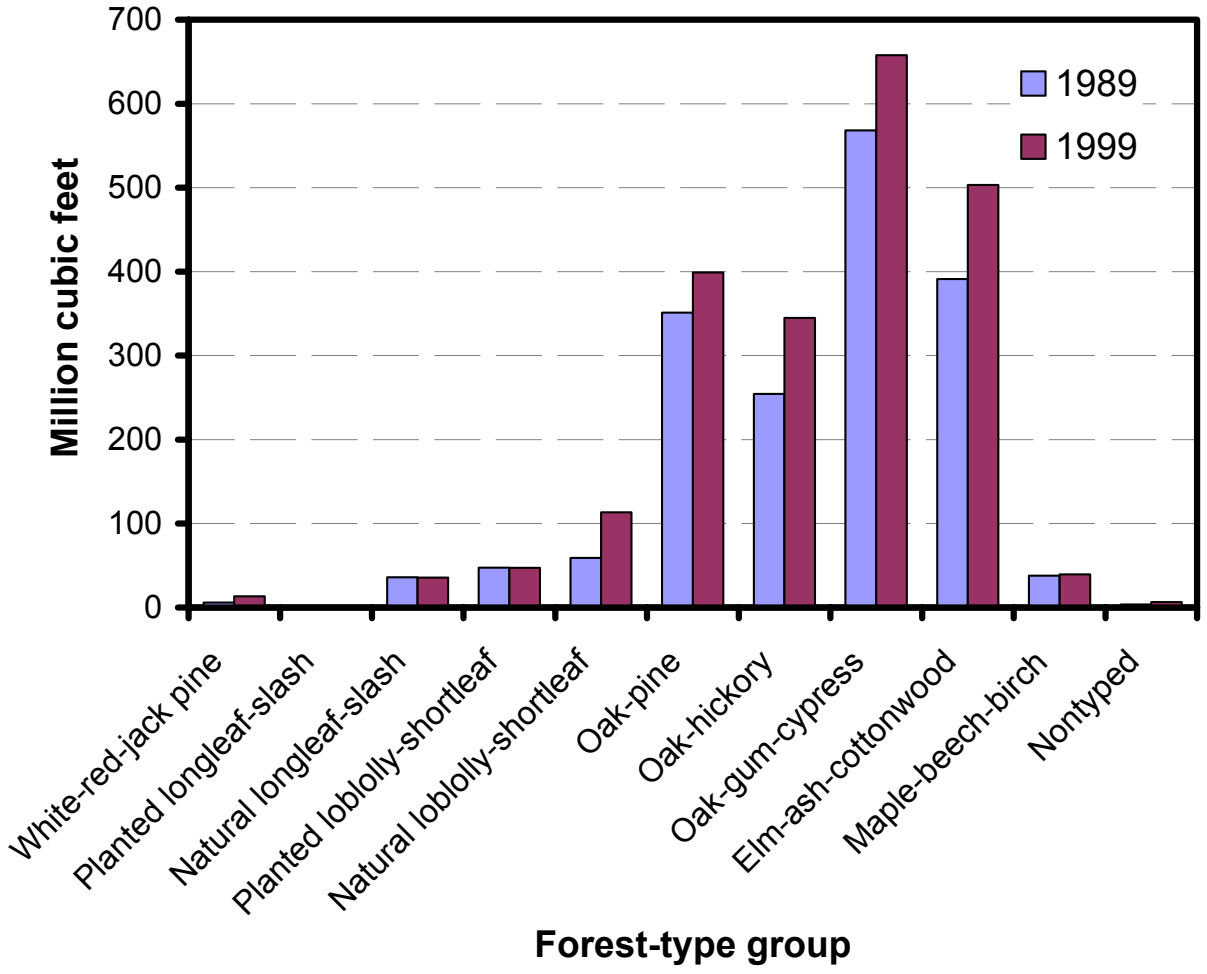

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Figure 33--Average annual growth to average annual removals ratios of growing stock on timberland by softwoods, hardwoods, and year, Southern United States.

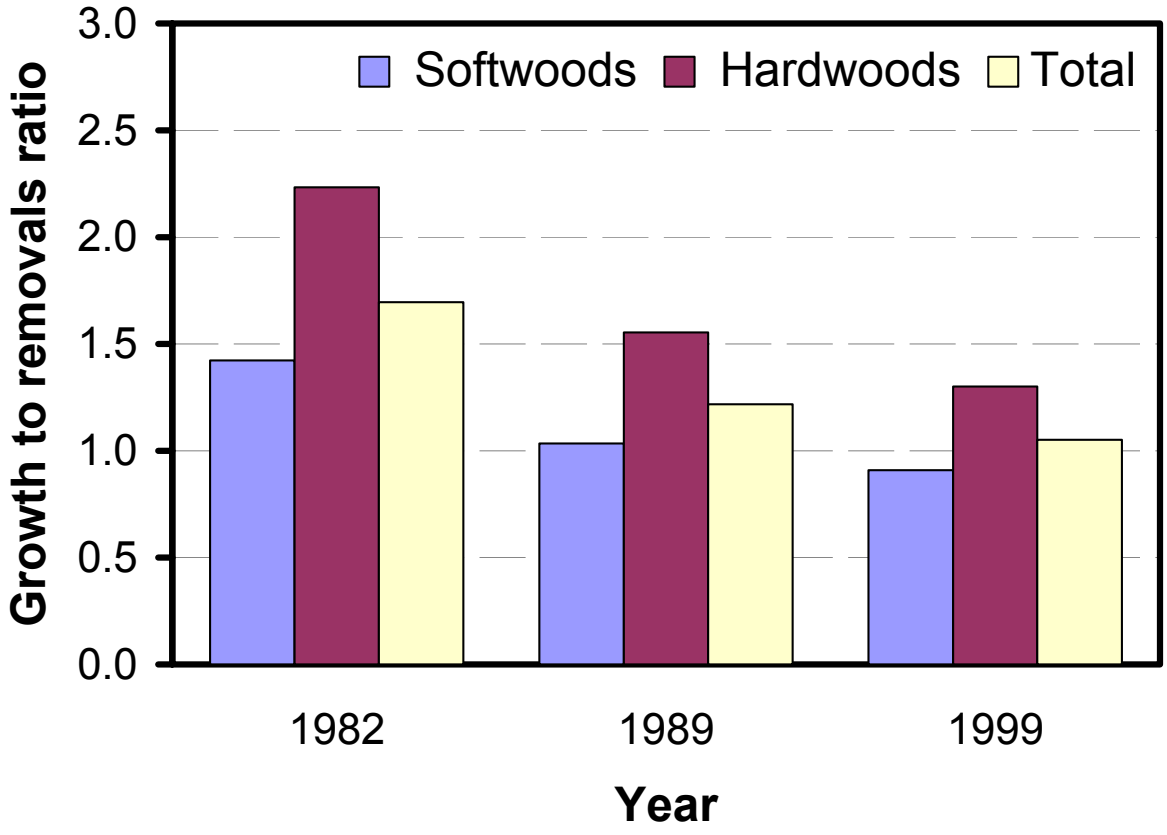

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Figure 34--Volume of softwood growing stock on timberland by stand origin and diameter class, Southern United States, 1999.

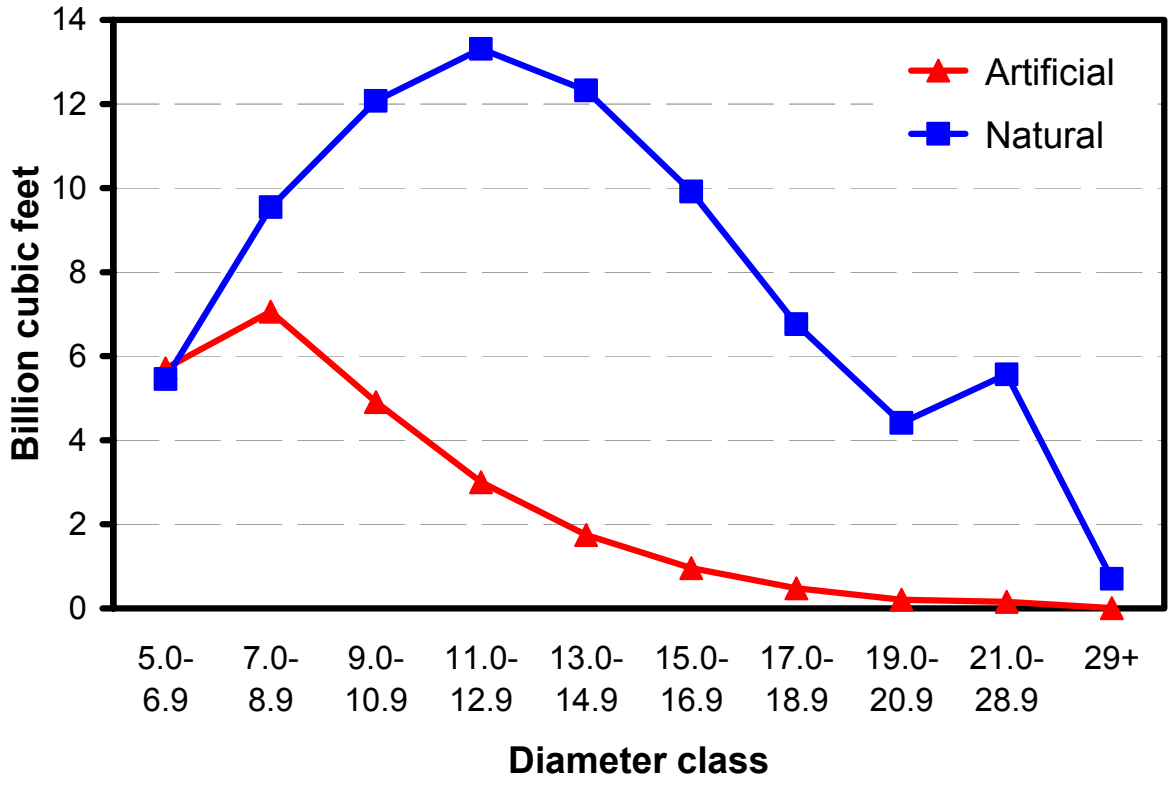

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Figure 35--Ecological Provinces of the Southern United States.

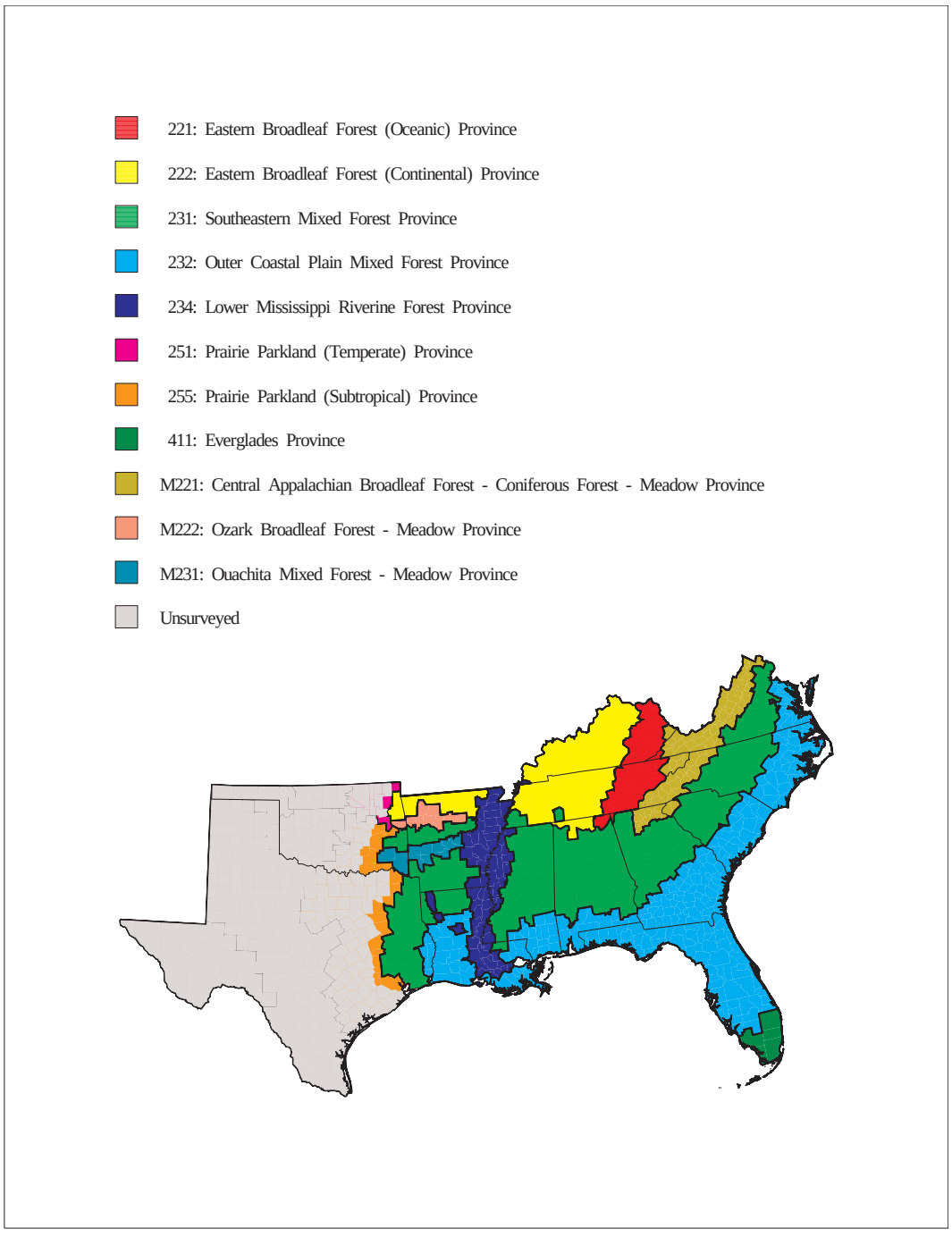

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Figure 36--Distribution of timberland by Province and forest-type group, Southern United States, 1999.

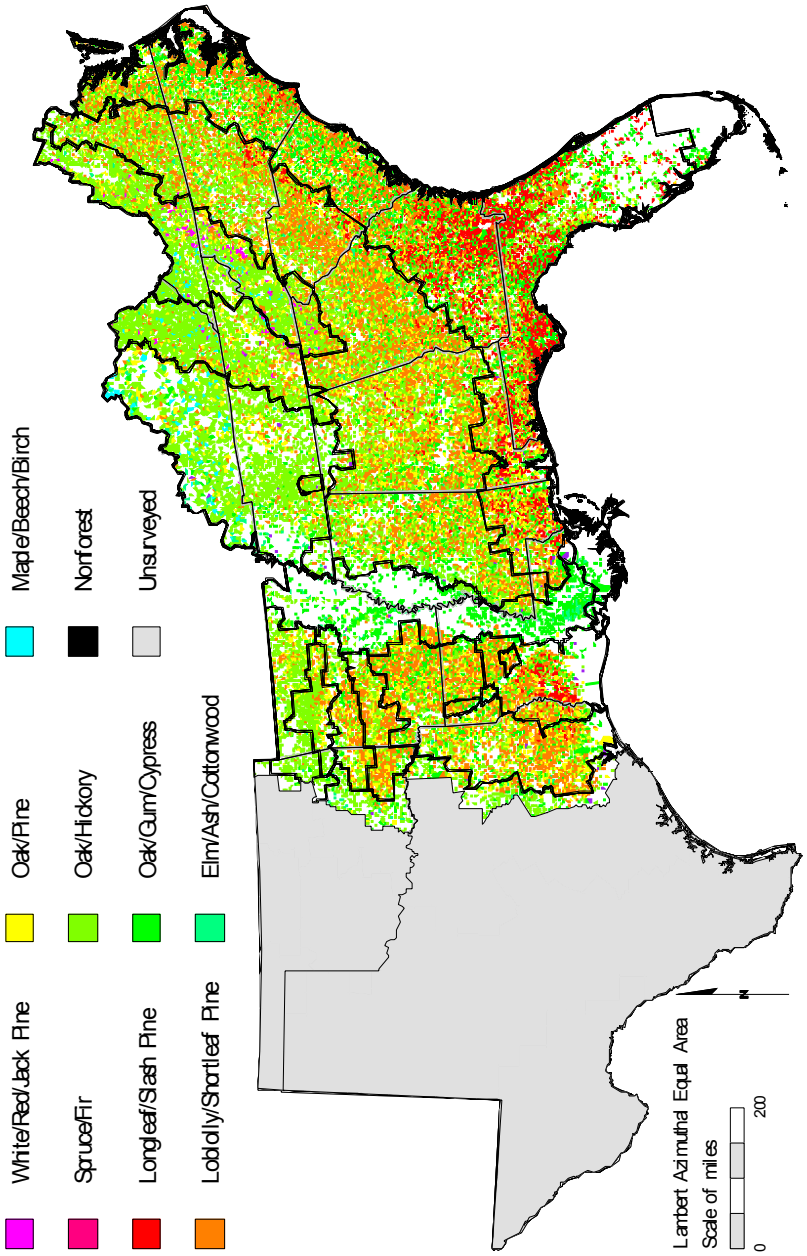

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Figure 37--Distribution of pine and oak-pine timberland, by stand origin, and Province, Southern United States, 1999.

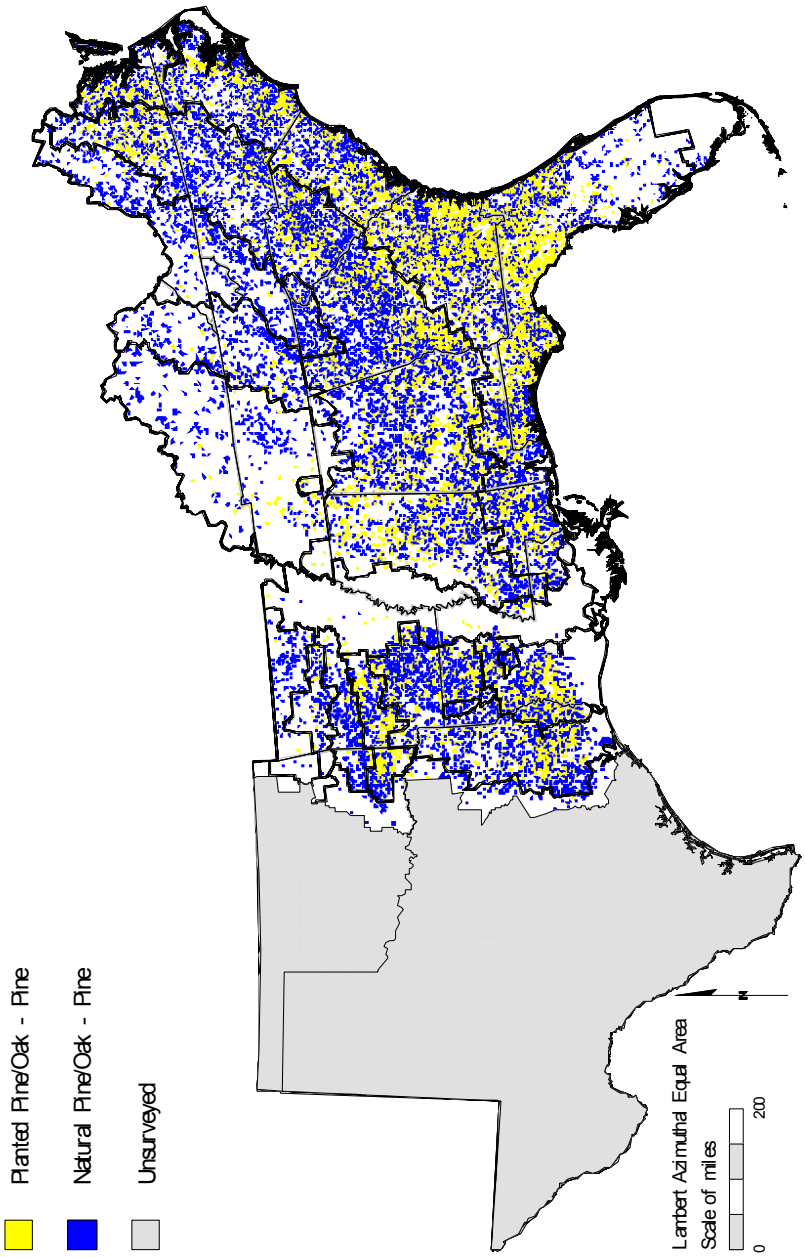

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Figure 38--Distribution of timberland by Province, and owner class, Southern United States, 1999.

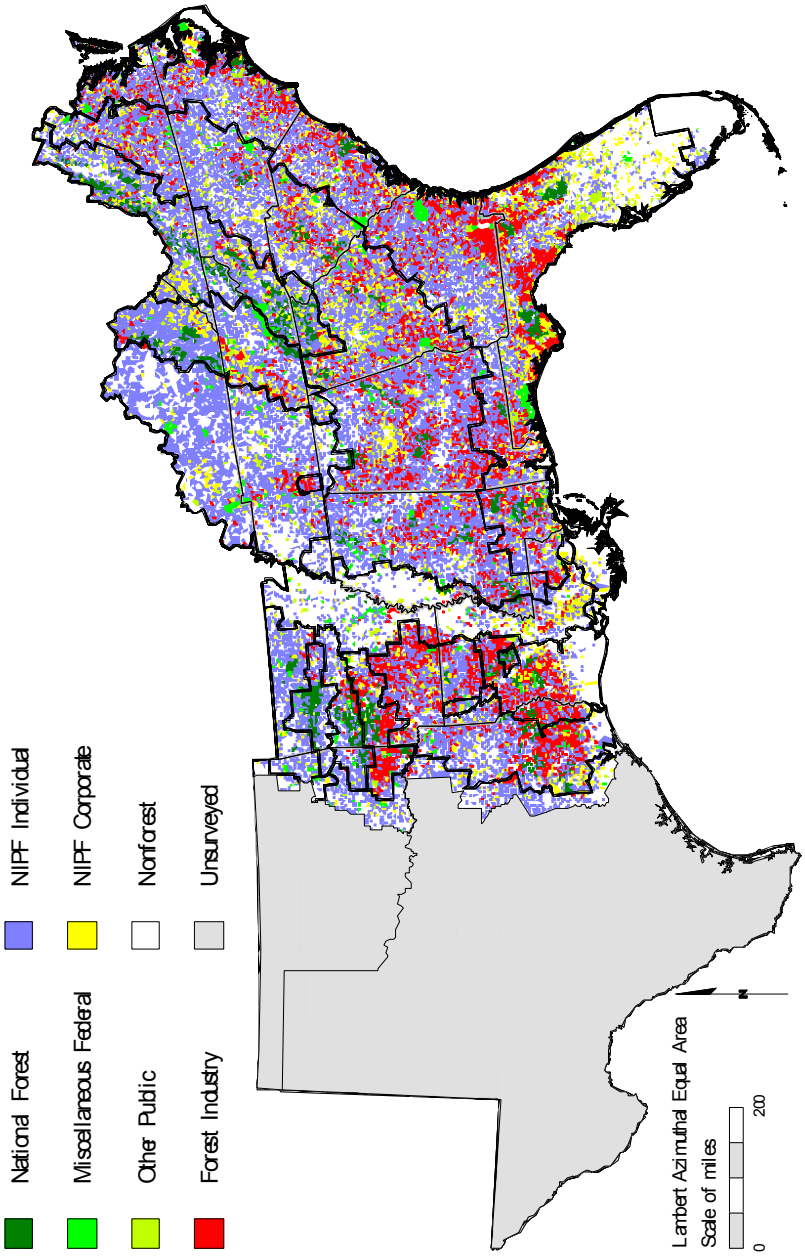

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Figure 39--Distribution of hardwood volume live tree volume on timberland per acre by Province, Southern United States, 1999.

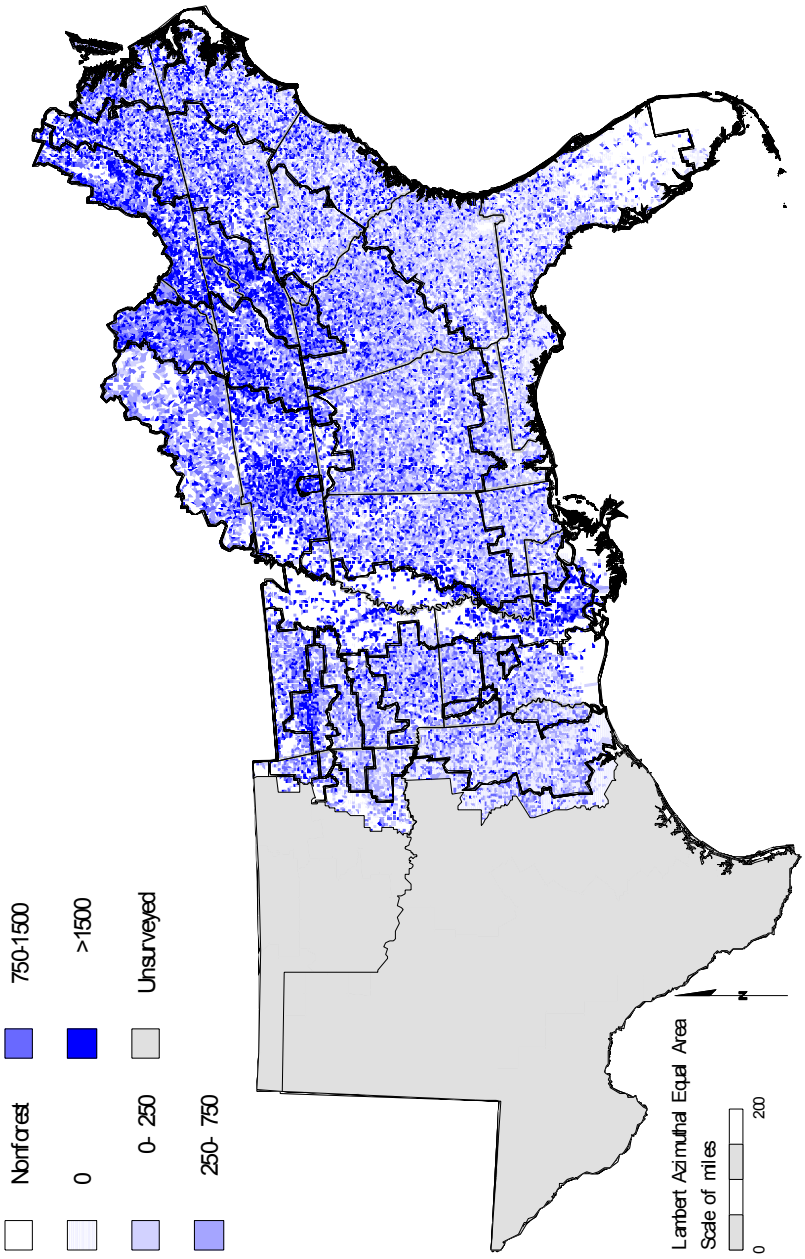

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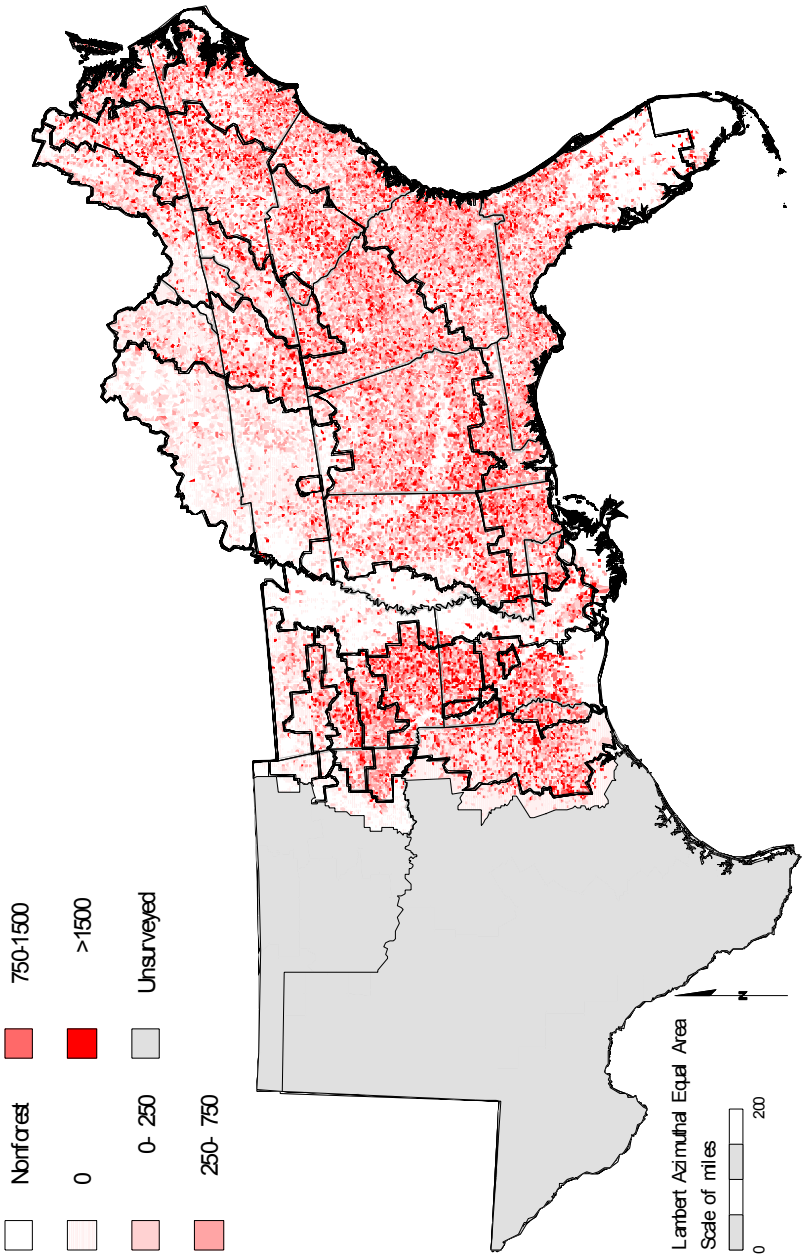
Figure 40--Distribution of softwood live tree volume on timberland by Province, Southern United States, 1999.



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